# AMERICAN PHILOSOPHICAL SOCIETY,

## HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXIX. JANUARY TO JUNE, 1891. No. 135.


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# EXTRACT FROM THE LAWS.

## CHAPTER XII.

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# PROCEEDINGS

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# AMERICAN PHILOSOPHICAL SOCIETY

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# *Vocabularies from the Musquito Coast.*

*By Daniel G. Brinton, M.D.*

(*Read before the American Philosophical Society, March 6, 1891.*)

Through the kindness of the Rev. W. Siebärger, a missionary of the United Brethren, now resident on the Musquito coast, I have obtained several new vocabularies from that region, which offer points of interest to the ethnologist.

The most important of these is a list of words from the language of the Ramas tribe, the first and only specimen of their tongue that I have encountered. These people live on a small island in Blewfield lagoon. They number at present about two hundred and fifty souls, all of whom have been converted to Christianity, and all of them are able to speak and read English except a few very old persons. Their native tongue is rapidly disappearing, and in a few years, probably, no one will be left able to use it fluently and correctly.

In physique they are described as large and strongly built; in temperament, submissive and teachable.

Their language has always been reported as wholly different from that of the Musquito Indians, who occupy the adjacent mainland, and this is shown to be correct by the specimen sent me. It bears, in fact, no relation to any other tongue along the Musquito coast. It does not, however, stand alone, constituting an independent stock, but is clearly a branch, not very remote, of a family of languages once spoken near Chiriqui lagoon, and thence across to the Pacific, or nearly that far.

To this stock I have, in my classification of American languages

assigned the name "Changuina," from its principal member, the Changuinas, who resided on the river of that name flowing into Chiriqui lagoon. It is said that some few villages of the stock may still be found about the headwaters of this stream.

My chief source of information about this family is derived from the small work of A. L. Pinart, published in Paris last year, entitled *Vocabulario Castellano-Dorasque, Dialectos Chumulu, Gualaca y Changuina.* M. Pinart knew of no members of the stock north of the Chiriqui lagoon, though Blewfields is more than two hundred miles to the north of it.

The following is the list of the words sent me. The orthography is German.

| | Rama. | | Rama. |
|---|---|---|---|
| Man, | *nikikna.* | Tongue, | *kup.* |
| Woman, | *kuma.* | Tooth, | *siik.* |
| Sun, | *nunik.* | Hand, | *kuik.* |
| Moon, | *tukan.* | Foot, | *kaat.* |
| Fire, | *abung.* | House, | *knu.* |
| Water, | *sii.* | 1, | *saiming.* |
| Head, | *kiing.* | 2, | *puk sak.* |
| Eye, | *up.* | 3, | *pang sak.* |
| Ear, | *kuka.* | 4, | *kun kun beiso.* |
| Mouth, | *kaka.* | 5, | *kwik astar.* |
| Nose, | *taik.* | | |

Of these the subjoined present more or less distinct Changuina analogies:

| | Rama. | Changuina. |
|---|---|---|
| Sun, | *nunik,* | *kelik-u.* |
| Fire, | *abung,* | *kebug-al* (fire-brand). |
| Water, | *sii,* | *si.* |
| Head, | *kiing,* | *kin-unuma.* |
| Ear, | *kuka,* | *kuga.* |
| Mouth, | *kaka,* | *kaga.* |
| Nose, | *taik,* | *θakai.* |
| Tongue, | *kup,* | *kuba.* |
| Tooth, | *siik,* | *su.* |
| Hand, | *kuik,* | *kula, kuluk.* |
| House, | *knu,* | *ku.* |
| One, | *saiming,* | *umai.* |

The words for man and woman, *nik-ikna* and *ku-ma*, may have been borrowed from the Musquito, *wa-ikna* and *ma-iren.*

The numerals in the Changuina stock appear not to have been

well defined, as they differ in all three dialects. The Changuina proper helps itself out with the Spanish: *umai*, one; *umai-dos*, two; *umai-tres*, three. The Gualaca dialect has *ku-e*, one; *ku-mat*, two; *ku-mas*, three. In both, "five" is "*kul-male*," a hand, which corresponds to the Rama *kwik-astar*.

The Rama words for "two" and "three," *puk-sak*, *pang-sak*, belong to a series of numerals which had an extensive adoption by several diverse families in Guatemala and Costa Rica, and probably are of South American origin. They are distinctly traceable to the Cuna or Darien language, in which we have, 2, *pok'-ua*, 3, *pak'-ua*, and these reappear in the Guatuso of Nicaragua. This is evidence that the Ramas reached their island after they had adopted these Cuna words. This was probably after the Conquest. We know that in 1674–81, the Governor of Costa Rica, Don Juan Francisco Saenz Vasquez, marched against the Changuinas on account of their turbulent character, and severely punished them. Perhaps at this time the Ramas entered their canoes and sought refuge along the coast, far to the north of their ancient seats.

My informant adds a few words of the Cuna or San Blas language, picked up by him on the coast, as follows:

| | San Blas. | | San Blas. |
|---|---|---|---|
| Man, | *tula, siradi.* | Foot, | *naga.* |
| Woman, | *hoam.* | 1, | *kuenohikua.* |
| Sun, | *tata.* | 2, | *pogua.* |
| Moon, | *nu.* | 3, | *pagua.* |
| Eye, | *ibix.* | 4, | *pakawa.* |
| Ear, | *auar.* | 5, | *atali.* |
| Hand, | *aregena.* | | |

Comparing this with the *Vocabulario Castellano-Cuna*, of A. L. Pinart (Paris, 1890), it appears to be a tolerably pure dialect of the tongue.

Mr. Siebärger also furnishes a vocabulary from the Twaka Indians. These natives live in a number of scattered hamlets about the headwaters of the Tungla or Princeapula rivers. The latter name is a compound of "Prinzo," the name of a tribe, and the Musquito *auala*, river.

From an inspection of the list, it is clear that they belong to the extensive Ulva stock, as I have assigned them from previous evidence in my classification of "The American Race." *

* *The American Race: A Linguistic Classification and Ethnographic Description of the Native Tribes of North and South America* (New York, 1891).

| | Twaka. | | Twaka. |
|---|---|---|---|
| Man, | *all.* | Tongue, | *taki.* |
| Men, | *mui.* | Hand, | *tingki*, or *tingma.* |
| Woman, | *yall, wana.* | Foot, | *kallni.* |
| Sun, | *ma.* | House, | *honi.* |
| Moon, | *waiku.* | Hill, | *assam.* |
| Star, | *yalla.* | 1, | *as.* |
| Earth, | *sau.* | 2, | *bo.* |
| Sea, | *kuma.* | 3, | *bass.* |
| Fire, | *ku.* | 4, | *araunka.* |
| Water, | *wass.* | 5, | *singka.* |
| Head, | *tunuk.* | 6, | *tiesko-as.* |
| Eye, | *makpa.* | 7, | *tiesko-bo.* |
| Ear, | *tappan.* | 8, | *tiesko-bass.* |
| Nose, | *nanglak.* | 9, | *tiesko-araunka.* |
| Tooth, | *annak.* | 10, | *sallap.* |
| Mouth, | *matikpas.* | | |

The word *tiesko* in the numerals 6, 7, 8, 9, is explained as a form of *tingki*, "hand." The numeral for "five," *singka*, sounds suspiciously like the Spanish *cinco;* but I find it also in other Ulva dialects. For "twenty" the Twaka expression is *mui aslui*, "the man one time," *i.e.*, all the fingers and toes counted at once.

Their expression of welcome, "How are you?" is *parrasta*, which explains the name of the Parrastahs, a tribe on the Rio Mico, belonging to the Ulva stock.

The plural suffix is *þalna.*

Their term for God, or the Supreme Deity, is *Ma papangki*, "Sun-father," which indicates that they are, or were, sun-worshipers.

The Twakas locate the seat of man's life and emotions, not in the heart, as most nations, but in the liver; and they have in common use such expressions as:

| | |
|---|---|
| *issing sawram,* | liver split = angry. |
| *issing pini,* | liver white = kind. |
| *issing sani,* | liver black = unkind. |

In this they differ from their neighbors, the Musquitos, who employ in such expressions the word *kupia*, heart.

## *On a New Species of Atalapha.*

*By Harrison Allen, M.D.*

(*Read before the American Philosophical Society, January 16, 1891.*)

ATALAPHA TELIOTIS, sp. nov.

Ears rounded much smaller than head. The internal basal lobe longer than broad, and without posterior projection. The external basal lobe longer than high, without notch at the base anteriorly. The hem occupying notch is half the height of the auricle and is ample. The tragus is coarsely crenulate on the outer border, slightly narrowed at the tip, which is not turned forward. The external surface is without a trace of ridge, and the notch at the base above the small basal lobe without a tubercle. Snout and lower lip quite as in other species of the genus, except that the chin-plate is somewhat wider.

Skull with groove on centre of face-vertex continuous with the anterior nasal aperture. Sagittal temporal ridge sinuate. The first upper premolar exceedingly minute, scarcely half the size of the corresponding tooth in other species; it can with difficulty be seen even with the aid of a lens. The lower premolars are nearer of a size than is the case in other species, the first being fully half the size of the second. The third lower incisor is rounded, minute, and without cuspules.

The membranes are much as in *A. noveboracensis*, but the terminal phalanx of the fifth finger is longer, and ends with a free end on the margin of the endopatagium. The membranes are attached to the foot at a point midway between ankle and the base of the toes.

The prevalent color of the hair is dark chestnut above, but lighter below. The base on the body is everywhere black, and the shafts buff. No ashy tips are anywhere seen. The ventral half of the side of neck is white. The hair is scanty along the ventral surface of the forearm and the proximal ends of the last three metacarpals. The dorsum of the interfemoral membrane is furred only at the basal third. The remaining characters as in *A. noveboracensis*.

This species is readily distinguished by the shape and small size of the ear and tragus, by the attachment of the wing-membrane to the foot, and by the peculiarities of the premolars in both jaws, as well as those of the third lower incisors. It agrees with a southern variety of *A. noveboracensis* (*A. frankii*) in the partially free dorsal surface of the interfemoral membrane.

The specimen was forwarded to me by Mr. J. G. Cooper, of the California Academy of Natural Science, in a bottle containing an example of *A. noveboracensis*, and it resembles this form so closely in coloration that at first I mistook it for an immature example of the species last named.

The specimen is in poor condition. After decomposition had set in, it had been preserved for a long time in strong alcohol.

Habitat unknown. but it is probably Southern California.

*Measurements.*

| | | |
|---|---|---|
| Head and body (from crown of head to base of tail) | 38 | mm. |
| Length of arm | 22 | " |
| " forearm | 37 | " |
| 1st digit .. Length of first metacarpal bone | 2 | " |
| 1st digit .. " first phalanx | 4 | " |
| 2d digit... Length of second metacarpal bone | 40 | " |
| 2d digit... " first phalanx | 6 | " |
| 3d digit... Length of third metacarpal bone | 40 | " |
| 3d digit... " first phalanx | 14 | " |
| 3d digit... " second phalanx | 15 | " |
| 3d digit... " third phalanx | 2½ | " |
| 4th digit.. Length of fourth metacarpal bone | 38 | " |
| 4th digit.. " first phalanx | 10 | " |
| 4th digit.. " second phalanx | 8 | " |
| 5th digit... Length of fifth metacarpal bone | 32 | " |
| 5th digit... " first phalanx | 7 | " |
| 5th digit... " second phalanx | 7 | " |
| Length of head | 12 | " |
| Height of ear from head | 4 | " |
| " " base of external lobe to tip | 6 | " |
| " tragus | 3 | " |
| Length of thigh | 14 | " |
| " leg | 16 | " |
| " foot | 6 | " |
| " tail | 39 | " |
| Width 2d interdigital interspace | 2 | " |
| " 3d " " | 10 | " |
| " 4th " " | 28 | " |
| Difference between 3d and 4th interspace | 18 | " |
| Length of forearm | 37 | " |

Thus the manal formula is 2–10–28–37, the difference between the third and fourth interdigital interspace 18, and is much the same as in *A. noveboracensis*.

The measurements of the body and of the metacarpals are within the range of these which can be made on specimens of *A. noveboracensis*. The second phalanx of the third finger is longer than the second; the second phalanx of the fourth finger is much shorter than the first; the second phalanx of the fifth finger is of the same length as the first. In these respects the measurements are in contrast with those of *A. novebora-*

*censis*. The thigh is shorter than the leg, while both are smaller than is the species named. The foot is shorter, while the tail is slightly longer.

Atalapha is the most aberrant of any of the genera of the Vespertilionidæ, as this family is at present defined. It presents features in common with the Emballonuridæ, the Molossi and the Phyllostomidæ. These remarks are appropriate at this place, since in *A. teliotis* the general plan of the ear is as in Emballonuridæ; the shape of the wing, especially as to the strength of the first metacarpal bone, the shortness of the fifth metacarpal bone as compared to others of its series, the rigidity of the phalanges of the fifth digit, the arrangement of the lines in the fourth interdigital space, the flexibility of the lips, the great height of the internal tuberosity and of the length of the epicondyle of the humerus, the reverted distal ulnar rudiment, the posterior deviation of the coracoid process, the presence of a distinct lateral lobe to the cerebellum, the number of the upper incisors (being restricted to two), and the general shape of the wing are as in Molossi; while the complete tympanic bone (forming a ring at the upper margin), the pisiform bone being palmad and articulating with the fifth metacarpal bone, the palmad distinctness of the metacarpal bones, the shapes and relative proportions of the ectoturbinals, the presence of numerous vertical raised muscle-bands on the endopatagium, the angle of the lower jaw not being deflected, but remaining in axial line with that of the horizontal ramus, the genus resemble the true Phyllostomidæ.

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## *Notes on Hebrew Phonetics.* *By J. Cheston Morris, A.M., M.D.*

(*Read before the American Philosophical Society, March 6, 1891.*)

It might seem extremely rash for one whose acquaintance with Hebrew scarcely extends to a knowledge of its letters to offer any observations upon them in the presence of those who have made an exhaustive study of the subject; yet I do so, as thinking that one who occupies "the room of the unlearned," and is looking at the matter from a distance rather than from the dust-obscured atmosphere of the conflict of opinions, may offer some hints which may prove of value, even though they may not be wholly new.

In commencing the study of Hebrew characters, one is struck with two facts: 1. That there is said to be no character representing a pure vowel sound. This, I believe, is not the case with any other known alphabet. 2. That a change was made during the Babylonian captivity of the Jews, substituting the present square characters for the more ancient form. Let us inquire, first, why this was probably done. At this time the sacred records were subjected to inspection of their conquerors, containing, as they certainly did, many things which would be more or less offensive to them, and calculated to cast ridicule if not bring persecution upon the ex-

iles. What more natural than for those who had charge of these records to endeavor to conceal their contents by such a veil as opportunity afforded, viz., that the ancient phonetic value of the letters had been lost and the meaning of the words so obscured that only those initiated by long study of the Jewish sacred mysteries and traditions could read them? In this way we have accounted for the rise of the school of the Talmudists, the study of the Mishna and Gemara, and the origin of the Kabbala. No word was to be pronounced as written; it had an inscrutable meaning only to be learned by the initiated and transmitted by the use of points added to the letters. Add to this the inherent difficulty of representing the sounds of any people in the vocabulary of another race; as instances of this, take the substitution of "l" for "r" by the Chinese in learning English, or the difficulty a Frenchman or German has in acquiring our "th," or the Greek *θ*; or, as more to the point, the substitution by the uneducated German Jew of "sh" for pure "s." There is something in the physical structure of the vocal organs of each race which is reflected in the vocables used by it. In the Hebrew race as met with to-day this ringing nasal character strikes us all forcibly.

After these introductory thoughts, we are struck with the fact that one of their Hebrew letters, the ע, *ngain*, is so variously pronounced as to make one seriously question its true phonetic value. Its place in the order of the alphabet, as compared with the Phœnician and Greek, is that of the Greek *omicron*; its form in Phœnician and in the old Samaritan is o. In many Hebrew dictionaries this value is given it. Take, again, the ו, *vau*, its place that of the Greek F, *digamma*, its phonetic value that of the Latin v, or English ou. May not our double u, *w*, represent this, as well as the German u, *fow*? The sound of ק, *quof*, is lost to Western languages, except so far as represented by *q*, to which we add a *u* to make it vocable to us. The letters ס, *samech*, and ש, *shin*, are represented by the Greek *σ*, *sigma*, and *ξ*, *xi*, but are found in an inverted order in the alphabet. [The confusion between these letters goes back to a far earlier period when we find two of the Hebrew tribes disputing over Shibboleth or Sibboleth.]

But the very first letter is a vocable which in all other alphabets is considered a pure vowel sound, a; the fifth, *he*, is another, ĕ; the sixth, *chayt*, is ē, or ch; the tenth, *yod*, is i, *iota*; and, as above, *vau* = ou, or u (or sometimes f or v), and *ngain* = o. We have thus all our usual vowel sounds except y, which we know in French as *ygrec*, and substitute usually for the Greek *upsilon*. In Hebrew we have two sibilants, *zain* and *tsaddi*, the latter of which occupies the alphabetical position in Greek of *upsilon*. If we now try to substitute in Hebrew, as ordinarily written, the above values for the letters, we shall find we have a perfectly vocable language. The names of men and places are given not very differently from our modern pronunciation of them as elucidated by the pointed Hebrew, when allowance is made for the difference due, as above stated, to racial intonation.

In some instances, two or three consonants are found together, but these may be regarded as familiar abbreviations for well-known words, just as D. L. W. means for us Delaware, Lackawanna and Western R. R., etc. In this way we may find that the Hebrew is really no exception as regards the presence of characters indicating pure vowel sounds; and, indeed, we have the authority of Josephus for the statement that it does. Chief among the words whose pronunciation was to be hidden was the name of the Deity—it was forbidden—and many, long, and bitter have been the controversies as to the true pronunciation of יהוה, *yod, hay, vau, hay.* Josephus says it was composed of four vowels.* He was a priest, and also well versed in Greek and Roman literature, and we may well accept his statement as reflecting the best learning of his times on Jewish matters. It seems to me that this ought to settle the question.

As to the consequences which would follow from such a view, I must leave them to those more competent to follow them out. It seems, however, to me that we would thus have better opportunities of comparing the Hebrew sacred records with those of all other ancient nations, and of clearing up much obscurity in ancient history and geography.

I would therefore suggest the following phonetic values:

| | | | |
|---|---|---|---|
| א | $= \alpha =$ a | ל | $= \lambda =$ l |
| ב | $= \beta =$ b | מ, ם final | $= \mu =$ m |
| ג | $= \gamma =$ g | נ, ן final | $= \nu =$ n |
| ד | $= \delta =$ d | ס | $= \sigma =$ s |
| ה | $= \varepsilon =$ ĕ | ע | $= o =$ o |
| ו | $= F =$ f or vow or ou or u | פ, ף final | $= \pi =$ p |
| | | צ, ץ final | $= \upsilon =$ y |
| ז | $= \zeta =$ z | ק | $= \quad =$ q |
| ח | $= \eta =$ ē or $\chi =$ ch? | ר | $= \rho =$ r |
| ט | $= \vartheta =$ th | ש | $= \xi =$ x |
| י | $= \iota =$ i | ת | $= \tau =$ t |
| כ, ך final | $= \kappa =$ k | | |

And illustrate by

AN ATTEMPTED TRANSLITERATION OF GENESIS X.

1. v ale tuldt bni-nē (ch) xm (ch) em v ipt v iuldu lem bnim aĕr (ch) embul
Noah Shem Ham Japheth

2. bni ipt gmr v mgug v mdi v iun (v) v tbl v mxk v tirs
Japheth Gomer Magog Madai Javan Tubal Meschech Tiras

* See Josephus, "Wars of the Jews," Book v, Ch. v, 7.

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3. v bni gmer axknz v ript v tgrme
Gomer Ashkenaz Riphath Togarmah

4. v bni iun alixe v trxix ktim v ddnim
Javan Elisha Tarshish Kittim Dodanim

5. male nprdu aii eguim barytm aix llxnu lmxpētm bguiem

6. v bni ēm kux v myrim v puth v knon
Ham Cush Mizraim Phut Canaan

7. v bni kux sba v ēvile v sbte v rome v sbtka v bni rome xba v ddn
Cush Sheba Havilah Sabtah Raamah Sabtechah Raamah Sheba Dedan

8. v kux ild at-nmrd eva eēl leiut gbr bary
Cush Nimrod

9. eva-eie gbr-yid lpni ieve ol-kn iamr knmrd gbur yid lpni ieve
Jehovah Nimrod Jehovah

10. v tei raxit mmlktu bbl v ark v akd v klne bary xnor
Babel Erech Accad Calneh Shinar

11. mn-eary eeva iya axur v ibn at-ninve v at-rēbt oir v at-klē
Asshur Nineveh Rehoboth Calah

12. v at-rsn bin ninve v bin klē eva eoir egdle
Resen Nineveh Calah

13. v myrim ild at-ludim v at-onmim v at-lebim v at-nptēim
Mizraim Ludim Anamim Lehabim Naphtuhim

14. v at-ptrsim v at-kslēim axr iyav mxm plxtim v at-kptrim
Pathrusim Casluhim Philistim Caphtorim

15. v knon ild at-yidn bkru v at-ēt
Canaan Sidon Heth

16. v at-eibusi v at-eamri v at-egrgxi
Jebusite Amorite Girgashite

17. v at-eēvi v at-eorqi v at-esini
Hivite Arkite Sinite

18. v at-earudi v at-eymri v at-eēmti v aēr npyu mxpēut eknoni
Arvadite Zemarite Hamathite Canaanites

19. v iei gbul eknoni myidn bake grre od-oze bake sdme v omre v adme
Canaanite Sidon Gerar Gaza Sodom Gomorrah Admah
v ybim od-lxo
Zeboim Lasha

20. ale bni-ēm lmxpētm llxntm barytm bgviem
Ham

21. v lxm ild gm-eva abi kl-bni obr aēi ipt egdul
Shem Eber Japheth

22. bni xm oilm v axur v arpkxd v lud v arm
Shem Elam Asshur Arphaxad Lud Aram

23. v bni arm ouy v ēul v gtr v mx
Aram Uz Hul Gether Mash

24. v arpkxd ild at-xlē v xlē ild at-obr
Arphaxad Salah Salah Eber

25. vl obr ild xni bnim xm eaēd plg ki bimiv nplge cary v xm aēiv iqthn
Eber Peleg Peleg Joktan

26. v iqthn ild at-almudd v at-xlp v at-evrmut v at-irē
Joktan Almodad Sheleph Hazarmaveth Jerah

27. v at-edurm v at-auzl v at-dqle
Hadoram Uzal Diklah

28. v at-oubl v at-abimal v at-xba
Obal Abimael Sheba

29. v at-aupr v at-ēvile v at-iubb kl-ale bni iqtbn
Ophir Havilah Jobab Joktan

30. v iei muxbm m-mxa bake spre er eqdm
Mesha Sephar

31. ale bni-xm lmxpētm llxgtm barytm lguiem
Shem

32. ale mxpēt bni-nē ltuldtm bguiem umale nprdu eguim bary aēr embul
Noah

ALSO OF JUDGES XII, 6.

v iamru lu amr-na *xblt* v iamr *sblt* v la ikin l dbr bn v iaēzu autu v ix-
Shibboleth Sibboleth
ethuĕu al mobrut eirden v ipl bot ecia maprim arboim v xnim alp.

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## *On the Grapeville Gas-wells. By J. P. Lesley.*

(*Read before the American Philosophical Society, March 6, 1891.*)

Mr. John Fulton, General Manager of the Cambria Iron Works, at Johnstown, Cambria county, Pa., has kindly furnished me with the following particulars of one of the most important and significant episodes in the strange story of Petroleum in Pennsylvania :

1. A report to him made October 12, 1888, by Edgar G. Tuttle, then Mining Engineer of the Company. This gives :—(*a*) the number of wells (27 or more) around Grapeville, in Westmoreland county, up to that date sunk and piped by different companies ;—(*b*) the length and sizes of the pipe line to Johnstown ;—(*c*) the pressures of gas at the well, at the 4th, 8th, 12th, 16th, 20th, 24th, 28th, 32d, 36th and 39th mile, and at the Cambria Works terminus.

2. A second report made to him two years later, February 25, 1891, by M. G. Moore, now Mining Engineer of the Company. This gives :—(*a*) the titles of eleven companies owning 85 gas-wells in the Grapeville district ;—(*b*) an account of the drilling especially of the Agnew well ;—(*c*) a table showing the decline of pressure at the Westmoreland and Cambria Companies' wells, from 386 lbs. on April 29, 1889, to 65 lbs. on February 2, 1891 ;—(*d*) a full table of the Co.'s thirteen wells, depths, dates of striking gas, the initial pressure of each, subsequently observed pressure at April 29, 1889, December 15, May 26, November 3, December 1, 1890,

January 5 and February 2, 1891, the first six wells starting with 460 lbs. and ending with 70 and 65 lbs. ;—(*e*) a diagram of the mode of piping the Agnew well ;—(*f*) a map of the country between Pittsburgh and Johnstown, showing location of groups of wells.

Mr. Fulton was prompted to sending me the data described above by his remembrance of my address, some years ago, at Pittsburgh, before the American Institute of Mining Engineers, in which I reiterated my belief on geological grounds in the comparatively speedy extinction of the rock gas industry of the country. He adds : "You will notice that recently one of the wells [at Grapeville] has been deepened to reach the 'Gordon sand,' and that a small supply of gas was found in this second and lower horizon of natural gas, but not enough to warrant any hopefulness of its maintaining the supply. A part of our works are being supplied yet with the natural gas from Grapeville, but it is weakening so fast that we have got to supplement it with artificial gases" (February 26, 1891).

My warrant for publishing in the Proceedings of this Society these most important geological and historical data is found in Mr. Fulton's words : "I do not think that there is anything in this report that is so private or confidential that it should not be made known; and you can therefore use the matter in these reports as you think wise. At the Cambria works we are using the Archer oil gas to take the place of the natural gas, and we are finding this to be a very good substitute. As you know, the Archer process consists in vaporizing fuel oil, and mixing at a very high heat steam with the oil. We have also opened our mines again here and are using coal in a great many sections of the works" (March 13, 1891).

October 12, 1888, the Westmoreland and Cambria Natural Oil Company owned seven (7) wells, located principally along Brush Creek, northeast of Grapeville, Westmoreland county, Pa. Three wells were connected with the pipe line ; the others were held in reserve, two of them being drilled to a thin crust of hard rock (silica) just overlying the gas sand, which served as a hermetical cover to prevent the escape of the gas, even at its high pressure in the gravel-sand rock beneath it.

This fact is important as explanatory of the retention of the gas in the rock for past ages.

The wells are 1100 to 1400 feet deep, according to their locality in the valley or on the hill, the gas rock lying nearly horizontal.

The pipe in the well is of 5 inch diameter.

The two wells, A, $A^1$, on the map, were turned on full for the pipe to Johnstown, the well R being turned on more or less as a regulator of the supply at the Cambria works.

The pressure at top of well was 335 lbs., as the 10-inch main to Johnstown would not stand a much higher pressure.

There seemed no difference in strength or volume of gas per minute blown off (free) by one of these wells, in Mr. Tuttle's presence, compared with that which he saw two years before at a free blow from a well just north of Grapeville Station.

The gauges were noted often, so as not to permit the pressure to rise much above 335 lbs.; and when this seemed likely to occur well R was shut sufficiently to reduce it again to 335. Formerly a weighted safety-valve, allowing a free blow, was used. Saturday evenings wells A, $A^1$ were closed, and only R used. "The gas in this field is not being wasted as formerly, or as greatly as it has been in the Murraysville field; and the prospects are that the Grapeville field will last the longer of the two."

"I understand that the flowing pressure in the Murraysville field is now [October 12, 1888] 250 lbs. The Grapeville wells have great volume. When one is blowing off in the air and then is shut quickly, the gauge runs up in fifteen or twenty seconds to 525 lbs. In some districts the wells require a minute, and even longer, to reach their normal of 500 lbs. The weaker or low-pressure wells require days to reach their normal pressure."

As it is impossible to store or tank gas, wells are now drilled to within a few feet of the gas horizon and "held" there. When the supply from other wells weakens, these wells are sunk into the gas rock, one after the other, to keep up the supply.

Wells that have broke through to the gas are restrained by a "packer," a thick, heavy rubber cylinder, 20 inches long, outside diameter $\frac{1}{2}$ inch less than bore of well, fastened at the ends to the pipe going into the well (see cuts). The end of this pipe fits into the end of another pipe, making a "slip joint;" rubber flush with the outer diameter of the pipe; lower joint generally perforated to admit the gas; pipe A lowered into the well (and, if necessary, pressed down) to slip into pipe B, bulging the rubber packer against the sides of the well, and effectually stopping the rise of the gas *outside* the pipes. It can then be controlled by a valve at the top of pipe A, at the well mouth. Before this invention the gas could be held only below a certain pressure, above which it would force its way between the pipe and the sides of the well and blow the whole casing into the air. The economy to a district of the new "packer" is evident.

"At present (October 12, 1888) there appears to be no weakening of the supply, except when unusual and sudden demands are made on the gas. If the supply weakens, or a greater supply is needed, more wells may be added to the line. This may require the laying of more pipe, or the replacing of the present 10-inch main by a larger one. The W. & C. Company own about 20,000 acres, controlling a large part of the gas field."

The companies and wells around Grapeville in 1888 were as follows:

Westmoreland and Cambria, 7 wells, drilled between 1885 and 1888, three of them piped to Johnstown.

Carnegie, 6 wells.

Southwest, 2 or more, piped to Connellsville, etc. (drilling also on Brush Creek).

Greensburg Fuel, 2 wells, piped to Greensburg.

Jeanette Glass Works, 2, piped one mile west to the works.

Philadelphia Co., drilling near New Salem.

Owners unknown, 8 or more wells.

The W. & C. Co. have also seven wells (about 1400′ deep), three miles northwest of Latrobe, on a northeast and southwest line 2½ miles long. The northern three have a 6 inch pipe to Latrobe. The other four have a 10 inch pipe running east by Derry Station, P. R. R., to Laurel Hill, where it feeds into the Grapeville-Johnstown main about ten miles from Johnstown. The flowing pressure of the wells supplying Johnstown is 200 to 275 lbs. per square inch. That of those suppiying Latrobe, 90 lbs.

Trial wells east of this field have been unsuccessful, very little gas being found.

Salt water flowed from some of the Latrobe group of wells.

The first and most northern well, the Fowler, was drilled in 1885, the last and southernmost, Miller, No. 3, in 1887. Their volume of gas does not equal that of the Grapeville wells, and requires a much longer time to gauge up to the same normal of 500 lbs.

The proposition at first made to land owners, to pay $40 or $50 for a 50 lb. well, and $1.00 extra for each additional pound, was *not* generally accepted.

*Pressures along the main at every four miles* (taken in 1886 and 1887) show the *loss of pressure by friction* in a pipe of 10″, increasing to 12″, 16″ and 20″, thus:

For first 20 miles 3250′, *ten* inch pipe of ⅜ in. wrought iron.
For next 12 miles, *twelve* inch pipe of ¼ inch " "
For next 7¾ miles, *sixteen* inch pipe of $\frac{5}{16}$ in. cast "
For last 1¼ miles, *twenty* inch pipe of (?) " "

In the first column of the following table H. S. means High side. At the 39th mile, the gauge is at "Reducer low side." C. W. means the Cambria Works at Johnstown.

*Table of Pressures to Show Loss by Friction.*

| Distance from well. | Size. of pipe. | 1886. —— | 1886. Nov. 13. | 1887. March. | 1887. March 15. |
|---|---|---|---|---|---|
| 0 | 10 in. | 155 lbs. | 200 lbs. | 320 lbs. | 333 lbs. |
| 4 | " | 149 | 182 | 313 | 320 |
| 8 | " | 132 | 170 | 285 | 295 |
| 12 | " | 120 | 148 | 255 | 261 |
| 16 | " | 112 | 129 | 208 | 212 |
| 20 | " | 84 | 100 | 166 | 168 |
| 24 | 12 in. | 75 | 85 | 132 | 130 |
| 28 | " | 63 | 70 | 95 | 95 |
| 32 | 16 in. | 55 | 58 | 75 | 76 |
| 36 | " | 53 | 51 | 54 | 37 |
| H.S. | " | 52 | 50 | 53 | 36 |
| 39 | " | 20 | — | 25 | 25 |
| C.W. | 20 in. | 20 | — | 25 | 25 |

*Table of Wells and Ownerships, February 25, 1891.*

| | | |
|---|---|---|
| Greensburg Fuel Gas Company | 5 | wells. |
| Southwest Natural Gas Company | 9 | " |
| Versailles Natural Gas Company | 3 | " |
| Youghiogheny Gas Company | 3 | " |
| Jeanette Glass Works | 4 | " |
| Manor and Irwin Gas Company | 2 | " |
| Westmoreland Specialty Company | 1 | " |
| Westmoreland and Cambria Natural Gas Company | 13 | " |
| Carnegie Brothers & Company | 11 | " |
| Philadelphia Natural Gas Company | 23 | " |
| National Tube Works | 6 | " |
| Total number reported by M. G. Moore | 85 | |

The W. & C. Company's 13 wells are all piped to Johnstown. Their depths and pressures at various dates may be found on a following table. The deeper are on the hilltops. They all get their gas in the Gants sand rock of Washington county. Well No. 12 was deepened with the design to reach a lower gas sand horizon; but the rope was cut by the sharp sand driven up by the gas issuing from the Gants sand. Before the tools could get through it they were lost, and fishing tools also afterwards; so the well was abandoned, and No. 13 (Agnew well) was drilled a short distance south of No. 12.

This new Agnew well reached the Gants sand January 15, 1891, went through it, and was cased with 8-inch pipe; packed just above the top of the sand; supplied with another inner 6-inch pipe; packed again at the bottom of the sand; and the Gants sand gas between the pipes laid into the Johnstown main.

Drilling was resumed through the 6-inch pipe, and stopped, February 21, 1891, at 2700 feet. The "Gordon sand" was found at 175 feet beneath the Gants sand, was 35 feet thick, and gave gas at only 30 lbs. pressure, which, however, in twenty minutes rose to 175 lbs., "when it was necessary to discontinue the test;" why is not explained. "While the *pressure* in the Gordon is now (February 25) very much greater than in the Gants, the *volume* is much *less*, as is clearly shown by comparing the *minute pressures;* that of the Gants being 65, and of the Gordon only 30 lbs." [A diagram of the pipe and packing arrangement for passing through the Gants sand, and drawing off its gas to Johnstown, is appended to Mr. Moore's report.]

Below the Gordon sand, for 1070 feet to the bottom of the well, not a sign of gas or gas rock was observable. [This only bears out all Mr. J. F. Carll's observations, published in his reports on the oil regions, especially his Seventh Report, I 5, just published by the Geological Survey of Pennsylvania.] The failure of the Agnew well to get a good supply from the Gordon sand does not necessarily condemn it over the whole Grape-

ville field, as it may be found in better condition in the central and northern parts of the field. Carnegie Bros. have begun drilling two or three wells to test the Gordon sand a little north of the centre of the Gants field, a mile from No. 10 (Sylvis well).

None of the Latrobe wells are piped to Johnstown.

*Grapeville.—Table of Minute Pressures at Various Dates.*

| No. | Name. | Depth. | Struck Gas. | At First. | Apr. 20, 1889. | Dec. 15, 1889. | May 26, 1890. | Nov. 3, 1890. | Dec. 1, 1890. | Jan. 5, 1891. | Feb. 2, 1891. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Klingensmith | 1100′ | Feb. 13, '86 | 460 | 390 | 250 | 180 | 100 | 95 | 75 | 65 |
| 2 | Henry..... | 1133′ | June, 1886 | " | 380 | 260 | 170 | 105 | 100 | " | 70 |
| 3 | Moore..... | 1149′ | " " | " | 390 | " | 175 | 100 | 95 | " | 65 |
| 4 | Welker..... | 1144′ | Oct., " | " | 380 | " | 170 | 105 | 100 | | |
| 5 | Brown ..... | 1224′ | May, 1887 | " | 390 | " | 180 | 100 | 95 | 75 | 65 |
| 6 | Ferree..... | 1312′ | Aug., " | " | 380 | 240 | 170 | " | 100 | " | 70 |
| 7 | Minsinger ... | 1466′ | Nov. 21, " | 410 | 390 | " | " | 95 | 85 | 55 | 40 |
| 8 | Shutts ..... | 1468′ | Feb. 13, '89 | 380 | " | 250 | 165 | 100 | " | 70 | 60 |
| 9 | Kipple ..... | 1360′ | Nov. 30, '89 | 260 | | 260 | " | " | 95 | 75 | 65 |
| 10 | Sylvis ..... | 1357′ | Jan. 13, '90 | 235 | | | 170 | 105 | 100 | " | 75 |
| 11 | Truxel ..... | 1267′ | Feb. 20, '90 | 225 | | | 180 | 100 | 95 | " | " |
| 12 | Byers ..... | 1350′ | Oct., 1890 | 125 | | | | | | | 60 |
| 13 | Agnew..... | 1420′ | Jan., 1891 | 75 | | | | | | 65 | 65 |

*The steady decline in minute pressure* from 386 lbs. on April 20, 1889, to 65 lbs. on February 2, 1891, predicts a speedy extinction of the use of natural gas at the Cambria Works.

Calculating the average *rate per day of the observed decrease* we find it to be as follows:

| | | | | |
|---|---|---|---|---|
| From April 20, 1889, | 646 days, | 321 lbs. | 2 lbs. | per day. |
| From Dec. 16, 1889, | 413 " | 188 " | 2.200 | " |
| From May 26, 1890, | 252 " | 107 " | 2.355 | " |
| From Nov. 3, 1890, | 91 " | 36 " | 2.525 | " |
| From Dec. 1, 1890, | 63 " | 30 " | 2.100 | " |
| From Jan. 5, 1891, | 28 " | 7 " | 4 lbs. | " |

I take this opportunity to suggest that we have in the decline of gas pressure in all wells of all gas regions the most cogent of arguments against the theory that *gas pressure* is produced by the *hydrostatic pressure* of the locality. For, it is self-evident that the hydrostatic pressure must remain always the same, and therefore cannot be the *vis a tergo* of a variable oil or gas pressure; otherwise this last should also remain constant to the last drop of oil and the last cubic foot of gas coming from the well. The gradual decline of gas pressure in every well and all wells is proof positive that it represents the gradual exhaustion of an *inherent force of self-expansion* not dependent upon any *hydraulic vis a tergo*.

## *Notes on Hebrew Etymologies from the Egyptian ANX. Enoch; Anoki; Enos.* By J. P. Lesley.

(*Read before the American Philosophical Society, March 6, 1891.*)

Forty years ago, in my Lowell lectures on the "Origin of Man," I gave my views of the Arkite symbolism embodied in the crux ansata, or ANX symbol of life. They were not accepted; but I still regard that line of investigation as one entirely germane to modern scientific research, and capable of bearing good fruit, although my application of it to the crux ansata is much less probable than I then thought it; for the latest archæological results are rather in favor of regarding that symbol as a rude drawing of the human figure.

My present purpose is to direct attention to the influence which the universal use of this symbol in all ages of ancient Egyptian history must have exercised over the philology of surrounding races. Its name, ANX, the living, the alive, life, etc., was certainly the most sacred word in the Egyptian language; in general and constant use in their religious literature; on the lips of all their thinkers, and, in fact, of all classes of the population of the valley of the Nile, in all generations; and was embodied as an element in the personal names of pharaohs, nobles, priests, and common people; the evidence of which pervades the monuments and papyri. Every royal cartouche had the *anχ* scrupulously written after it, usually with the *tat*, to mean *the ever-living, the immortal*. *Pa anχ* is an instance of the designation of a pharaoh (Pierret). The use of the *anχ inside* the cartouche was later; for example, in the Ethiopian kingdom, and by Psammeticus II and III. The granddaughter of Pianchi II was named *Anχ-shap-n-ap;* the daughter of Takelot II, *Anχ-karama-t;* a princess of the family of Psammeticus II, *Anχ-ra-nefer-het*. Two places or cities in Egypt are known called *Xafra-anχ* and *Aseska-anχ*, evidently dedicated to the memory of the Kas, or spirits, of those monarchs, one of whom built the second great pyramid of Gizeh. A quarter of the oldest capital of Egypt, Memphis, was known as *Anχ-taui*, the life (or heart) of the two lands, Upper and Lower Egypt.

The word was popularly used, like our word "viands," for food of any kind that supports life. *Anχ-am* was the name of a tree, used as we use the word "live-oak;" and Lepsius quotes a curious sentence of great interest to Hebrew scholars: "Ra, the sun, who makes the tree of life (*am n-anχ*) green, producing things which issue from it," suggesting the "tree of life" (עֵץ הַחַיִּים, more properly *the tree of living things*) of the garden of Eden.

The Egyptians seem to have used *anχu*, also, as the general plural name for all flowers, the plainly living parts of plants.

The Egyptians called a mirror *anχ*, because it represented the living object presented to it. They called the two eyes *anχ-ti*, because the life of an animal is best seen in his eyes. But they gave, curiously enough,

the same name to the two ears, and only distinguished the terms apart in writing, by drawing the ideograph of eyes in the one case and of ears in the other. The pharaohs had two high officials, one called "his eyes in the south," and the other called "his ears in the north."

But *anχ* not only meant to live, to be alive, but had another derivative meaning, with a very remarkable application to the story of Enoch, viz., *to lift oneself, to rise up* and stand, *resurrection* and *ascension*. This meaning it retains in modern Coptic, as ONK, *extulit, assurexit*. An inscription at Edfu uses it for "the sun rising in the east." At Denderah is a picture of a sacred boat, in which stands a lotus flower, from which a snake is rising into the air, with the legend: "The snake ascends (*anχ*) from the lotus of the ship." On the sarcophagus of Besmut, at Luxor, is read, *anχ-f*, etc.: "He ascends like the ten stars." Another inscription reads: "The stars ascend (*anχu*) in heaven." And at Esne: "The stars ascend (*anχu*) to do their duty in the night." At Abydos, an inscription to King Seti I, of the nineteenth dynasty (before the date of the Exodus), addresses him thus: "Thou goest up (*χa-k*) above the earth like the bark of Orion in its season; thou arisest (*anχ-ta*) like the Star Sothis" (see Brugsch's Dict., pp. 198, 199).

The Hebrew tradition that the Hebrews came out of Egypt agrees with the fact that Moses, Aaron, Hur (named together, Exod. xvii, 10), Miriam, Achsaph (Caleb's daughter), Manassah (Joseph's son), and other early legendary personal names, are purely Egyptian. The intercourse of the two peoples was always intimate. The kings Asa, Amon and Manasseh had Egyptian names. Before the exile, the Hebrew colonies in the Delta were important. The Book of Genesis was not necessarily compiled at Jerusalem. The story of Joseph and Potipher's wife was based on the D'Orbigny papyrus. Adam and Seth seem to be the names of the two chief Delta deities Atum and Set. Noah and his wife seem to represent the Egyptian divine duad Nun and Nunt. There is nothing startling, therefore, in finding the *anχ* in the name Enoch, whose legend forms an episode in the antediluvian list.

The occupation of Southern Syria by the Egyptians dates back to the most remote times. The cartouche of Snefru, first king of the fourth dynasty, builder of one of the great pyramids, is cut on the rocks of the Sinaitic peninsula, at the turquoise and copper mines. The Hebrew legend of the *Anakim* of the Hebron country gives Anak three sons with Egyptian names, Ahiman, Sesai, Tolmai, fathers of the three tribes of the Anakim. Whether there was any philological connection or not, the compilers of Exodus seem to have seen the *anχ* in the name *Anak*, and described therefore the people as a giant race, analogous to the ghostly or demoniac Rephidim.

Remembering the large Greek element in the Delta far back in the centuries before Christ, and the Greek tradition that as Cadmus came from Phœnicia and settled Bœotia, so Cecrops came from Sais in Egypt and settled Attica, bringing with him the goddess Neith (Pallas Athéné), we

might confidently expect many Egyptian words and names in Greece. Of these I will only allude to *Inachos* (*anch*), son of Oceanus and Tethys, who founded the Kingdom of Argos; and the sacred rivers *Inachos*, one in Argolis, the other flowing from Mount Pindus.

But to return to proper names in Hebrew; perhaps the most interesting of them all, in an etymological way, is that of *Enos*, the legendary grandson of Adam, in the second account of the creation in the fifth chapter of Genesis, the chapter which contains the name of Enoch. The word Enos is written, whether rightly or wrongly, אנוש, and pointed so as to be pronounced ănosh. The same word, written and pointed in the same way, occurs in the 55th Psalm and Job v, 17, with the meaning *a man*, but usually appears in the Hebrew books with a collective meaning as *mankind*. It occurs in *Son of Man*, Ps. cxliv, 3. Isaiah viii, 1 is directed to write with a *man's stylus*, that is, in the vulgar or common or demotic scrip, so that everybody could comprehend. Like Adam (man) it had no plural. But in later days, as when the Book of Daniel was written, the third letter had been dropped and the word became *ansh*, or emphatically *anshá*, meaning *man, mankind, man as man;* and this gave the common plural *anshim*, *men*. It repeatedly occurs in this book in the phrase "Son of man." A still further contraction of it gave the popular form AIS*h*, איש, *man*, with its feminine *aishé*, *woman* (as the Greek ἑνς, *one*, was contracted into ἑις, with a closer connection between the two languages than Gesenius here suspected).

In the pronunciation of words we must keep in mind that until the age of printing spelling has always been optional, and pronunciation local. Words passed from ear to ear, not from eye to eye. The same word was pronounced gutturally or dentally or lingually by different races and individuals, and written accordingly. Words were clipped, and written accordingly. Every Egyptian, Hebrew or Greek scholar knows this. Whether the *Anch* was spelled with an aleph, heth or áyen, it remained the same word. In one part of Egypt it was pronounced *anχ*, in another part *ansh;* just as the East Germans say *ich*, the North Germans *ik*, and the West Germans *ish*, for the English *I*, which the Greeks and Romans pronounced *eg-o*, the Hebrews *anoki*, the old Egyptians *nuk*, and the Copts *anuk*. By reference to Admiral McCauley's Dictionary, published in our Transactions in 1882, you will see at the top of the first column, on page 22, "*Anχ*, life;" followed by "*Ansh*, to exist, to subsist." Other proofs it is unnecessary to adduce to show the practical identity of the Egyptian *Anχ*, *life*, and the Hebrew *Anosh*, *Ish*, *man*, *Enos*.

As to the genetic connection of *Anχ* and the Hebrew *Anoki*, *I*, the first personal pronoun, I would approach the subject with all possible caution. It is a fact that the pronoun was written *Ani*, without the *k*, especially in what Gesenius calls the "silver age of the Hebrew," Eccles. ii, 1, 11, 12, 15. 18, 20; iii, 17; iv, 1, 2, 4, 7; vii, 25. In Gen. xv, 7, and xxiv, 24, it stands alone (including the substantive verb) for *I am*. Schwartze, in his "Coptic Grammar," pp. 340, etc., seems to quite settle the fact that the final

guttural was not a characteristic element of the first personal pronoun. And yet Gesenius seems to feel no hesitation in saying that the Hebrew *Anoki* (ANKI) "is the *primary* and fuller form of *Ani*," being more frequent in the Pentateuch (but in general more rare) than the shorter form *Ani;* and in some of the later books, as the Chronicles and Ecclesiastes, wholly disappearing, just as the guttural of the Saxon has been lost in modern English, and that of the Franks in modern French. He notices that the form *Anoki* occurs on the Phœnician monuments and in the Chinese NGO. The Sanskrit used only the guttural *aha*, like the Greek, Latin, German, etc., while the Aramaic, Arabic, Abyssinian have lost it, and use the shorter nasal form of the pronoun. It seems hardly possible, therefore, to avoid the conclusion that ANK was the primitive form of the first personal pronoun, and that it stood in genetic relationship to the Egyptian symbol of life, the *anχ*. Whether the symbol was constructed from the ideograph for *I* (a man with his arm bent pointing to his mouth) or not, I leave to the judgment of others.

But Gesenius remarks somewhere that *Anoki* is used in some Hebrew passages as an emphatic *I myself*. This would point to the constitution of the pronoun as a dissyllable, with a final KA, the well-known hieroglyph for the dead man's *spirit*.

I should like to draw attention to the identity of *ani*, the pronoun, and *ani*, the Hebrew (and generally Shemitic) word for *vessel*, not only a vase, urn, bucket, etc., for holding water especially, but also a *ship*. The human frame was called a *vessel* (of wrath or righteousness, of mercy, etc., etc.), and may easily have been originally regarded as the *vessel of life* par excellence. Were this idea feasible, it might return us to my former arkite (ship-mountain-water) interpretation of the *crux ansata*.

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## *On an Important Boring Through 2000 Feet of Trias, in Eastern Pennsylvania. By J. P. Lesley.*

(*Read before the American Philosophical Society, April 3, 1891.*)

*The Eastern Oil Company's trial bore-hole on the Stern farm at Revere (Rufe's Corner), Bucks county, Pa.*, is 18 miles south of Easton, 16 miles north of Doylestown, 7 miles west of Riegelsville, 5 miles from Kintnersville, 8 miles from Munroe, 10 miles from Durham furnace, 1½ miles from Bucksville, 2½ miles from Ottsville, 4 miles from Ervina, and about 2 miles east of Haycock trap hill.

The following record was written from dictation of Mr. E. C. Rosenzi, 3414 Smedley street, Tioga, Philadelphia, February 25, 1891, Superintendent of the Company.

This is the first deep boring in the Mesozoic belt of Pennsylvania,

known to me. Had my advice been asked I should have dissuaded from a costly attempt to find oil or gas in this formation. The record of the boring, however, is valuable to the geological student as the hole descends through 2076 feet of nearly horizontal strata of gray and brown mostly soft sandstone and shale, with some dark ("black") slate, one stratum of which (called "anthracite coal") produced an excitement in the district, and was extensively published by the newspapers.

It is almost needless to say that a bed of *anthracite* coal in undisturbed strata of Mesozoic age, and at a distance from trap, would be an incredible occurrence. The trap of the Richmond, Va., field only turns the bituminous coal bed to coke.

It is also hardly necessary to explain that a "*nine foot bed* of anthracite coal" anywhere in the brownstone belt of Bucks and Montgomery counties could hardly conceal itself underground. All the strata crop out to the surface; and such a stratum could not well escape exposure. Even smaller lenticular bituminous coal seams like those on Deep and Dan rivers in North Carolina, ranging in thickness from four feet down to one foot, show somewhere at their outcrops. Even if the well record at this point of it were clearer than it is, the fact of the existence of any considerable coal bed (especially an anthracite bed) would have to be carefully verified, either by several additional trial holes, or by a shaft, before being believed by any geologist versed in the characteristic features of this formation.

Riegelsville is 166′ above tide, and the Revere well mouth is supposed to be about 200 A. T. Its record is as follows:

| | | |
|---|---|---|
| 8′ | Alluvion.....From the surface down to | 8′ |
| 102 | Sandstone, brown.....Down to | 118 |
| 15 | Shale, red..... | 133 |
| 5 | Shale, bluish, soft ..... | 138 |
| 10 | Shale, blue, hard ..... | 148 |
| 56 | Sandstone, dark brown; *with coaly specks*..... | 204 |
| 7 | Sandstone, brown, very fine grained ..... | 211 |
| 2 | "*Black slate*," soft..... ..... | 213 |
| 4 | Shale, blue, hard ..... ..... | 217 |
| 223 | Sandstone, red, very hard ..... | 440 |
| | Slate, purplish, very gritty, here. | |
| 4 | Sandstone, brown, fine grained..... | 444 |
| 31 | Sandstone, gray, very micaceous ..... | 475 |
| 10 | Sandstone, gray, hard rock..... | 485 |
| 100 | Sandstone, reddish brown ..... ..... | 585 |
| 5 | Sandstone and shale, gray ..... ..... | 590 |
| 5 | "*Black slate*," soft..... | 595 |
| 32 | Shale, reddish blue, very hard ..... | 627 |
| 44 | Sandstone, reddish brown ..... | 671 |
| 21 | Sandstone, brown, and blue shale, coarse and fine.... | 692 |

| | | |
|---|---|---|
| 53 | Sandstone, brown, coarse and fine | 745 |
| 55 | Shale, brown | 800 |
| 77 | Sandstone, bluish red, hard; with white clay veins | 877 |
| 63 | Sandstone, brown, fine grained | 940 |
| 40 | Shale, brown, soft. *"Show of petroleum"* | 980 |
| 30 | Sandstone, brown, hard. *"Show of petroleum"* | 1010 |
| 15 | Shale, *grayish black* | 1025 |
| | Shale, blue, here. | |
| 55 | Sandstone, red-brown, hard | 1080 |
| 70 | Sandstone, red-brown, hard | 1150 |
| | *Here cased off the fresh surface water.* | |
| 5 | *No record of this interval* | 1155 |
| 31 | Shale, pink | 1186 |
| 64 | Shale, pink | 1250 |
| 10 | *"Black slate, hard"* | 1260 |
| 90 | Sandstone, red, "like the mass at 1150" | 1350 |
| 40 | *"Black slate, hard"* | 1390 |
| | Here, gray sandstone. | |
| 16 | Sandstone, gray, hard; with very minute white pebbles as large as pins' heads | 1406 |
| 3 | *"Sand perfectly black and gritty;* boring easy" | 1409 |
| 31 | Shale, light gray, gritty | 1440 |
| 7 | Shale, reddish | ... |
| 6 | Shale, dark blue | |
| 42 | Shale, light gray | |
| 12 | Shale, reddish, hard and gritty | 1506 |
| 39 | Shale, reddish | 1545 |
| 15 | Sandstone, bluish gray, fine grained rock | 1560 |
| 9 | "COAL, ANTHRACITE" | 1569 |

Here, in answer to my verbal objections to the notes in his well book, Mr. Rosenzi explained that the thickness might be incorrect, owing to the churning of the tools, but that it was in his opinion "certainly 5½ feet;" and that the "coal" came up in fine specks (no larger than the head of a pin) like all the other crushed and ground-up sand pumpings from the well, from top to bottom. No larger pieces were obtained: and no analyses were made. The well was worked in brackish water, which afterwards became salt water. *See below at 1616*, where salt was first noticed on the board walls of the derrick.

| | | |
|---|---|---|
| 10′ | *"Black slate rock, very hard"* | 1579′ |
| 25 | Sandstone, gray, fine, softer | 1604 |
| 6 | Sandstone, brown, hard rock | 1610 |
| 6 | Sandstone, gray, fine, softer | 1616 |
| | Here cased off the "salt water." | |
| 8 | Sandstone, first dark, then light gray | 1624 |
| | "Here salt water again and plenty of it." | |

I could get no clear idea of this from Mr. Rosenzi's description. He first noticed the salt as a deposit from water splashed on the derrick. The salt taste was decided. He could say nothing about the flow, as the well was always full of water, but I could not learn that any stream issued from the mouth of the well.

| | | |
|---|---|---|
| 16′ | "*Black slate*, coarse, mixed with minute specks of COAL, and minute light gray pebbles | 1640′ |
| 9 | Sandstone, coffee-colored | 1649 |
| 5 | Sandstone, brown, very fine | 1654 |
| 9 | Sandstone, brown, very fine | 1663 |
| 21 | Sandstone, brown, very fine | 1684 |
| 5 | Sandstone, brown, dark | 1689 |
| 10 | Sandstone, gray, dark, hard | 1699 |
| 5 | Sandstone, gray, light, sharp | 1704 |
| 17 | Sandstone, brownish red, of usual character | 1721 |
| 15 | "*Black slate*" | 1736 |

"*Cased well against salt water in black slate, at 1736.*"

"The driller remarks that here came in genuine soft black slate, which he recognized as the overlayer of the Oil Sand in Allegheny county, in the Wild Wood district where he worked." Nothing could more forcibly illustrate the ignorance of the well drillers as a class than this astounding statement; which is only exceeded by the ignorance of oil and gas speculators as a class, and the stockholders of the companies which they form, in giving ready credence to such statements from men whose only interest is that of obtaining their daily pay for boring wells.

| | | |
|---|---|---|
| 2′ | Sandstone, gray, fine, like 1604 | 1738′ |
| 14 | Sandstone, brown, fine, hard | 1752 |
| 28 | Sandstone, brown, coarser | 1780 |
| | *Cased off salt water successfully at 1782.* | |
| 5 | Sandstone, brown, fine | 1785 |
| 5 | Shale, gray, hard | 1790 |
| 30 | Shale, grayish black | 1820 |
| 9 | Shale, light gray, bluish, hard | 1829 |
| 3 | "Blue Monday," (a term used by the drillers in Western Pennsylvania) | 1832 |
| 26 | Sandstone, bluish gray | 1858 |
| 2 | Shale, gray, hard | 1860 |
| 10 | Shale, brown, soft | 1870 |
| 8 | Sandstone, gray, sharp | 1878 |
| 82 | Sandstone, brown (or red), hard | 1960 |
| 35 | Shale, pink (or red), soft | 1995 |
| 89 | Sandstone, brown, coarse (February 21, 1891) | 2084 |

I suppose that the boring is to be carried on to greater depth.

Mr. Benjamin Smith Lyman, Assistant on the Geological Survey of the State, whose Report on the Trias Brown Sandstone Belt of Bucks, Montgomery and Chester counties, Pa., is not yet quite ready for publication, informs me that the place assigned to *coal* in the above well record would come about 11,000′ below the top, or 10,000′ above the bottom of his general section of the formation ; the coal-bearing shales of Phœnixville being say 3500′ or 4000′ above the conglomerate base.

His long and exhaustive survey of the district has resulted in giving a combined thickness of more than 21,000 feet to these Mesozoic strata ; in a demonstration of the duplication of its measures along the Delaware river ; and in the discovery of both longitudinal and transverse anticlinal and synclinal flexures of considerable size. The latter system of folds is a very remarkable phenomenon, seeing that the folds lie with their northern ends abutting against (or riding over) the Durham hills, that range of Azoic highlands which extends from Reading into Northern New Jersey.

Mr. B. S. Lyman said :

Although the precise position of the Revere, or Rufe's Corner, well-boring has not been indicated within several hundred feet, it appears that the so-called coal bed is part of a 600 or 800 feet thick series of generally hard green and dark-red shales at something like 11,000 feet below the top of the Mesozoic rocks, mainly red shales, of Bucks and Montgomery counties, and 10,000 feet above the bottom of them, and 6000 feet above the hard blackish shales of the Phœnixville tunnel.

With a sketch he showed the course of the outcrop, a mile or so in width, of the green and dark-red shales, including the so-called coal bed and one or two other blackish shale layers, with generally a gentle northwesterly dip, from the Delaware river near Milford, N. J., along the east, south and west sides of a basin to Rufe's Corner ; thence northwestward, westward and southeastward, round Stony Point and Bucksville, in saddle form, east of the Haycock mountain, nearly to Ottsville ; then in almost a straight line southwestward for a dozen miles, past Perkasie and Sellersville ; and five or six miles further southwest, though bending slightly northward at Tylersport upon the southeastern disappearing end of a rock saddle ; but near Sumneytown bending sharply round a more important saddle so as to reach Harleysville, half a dozen miles to the southeast ; and there with a like decided bend in the opposite direction, but with a wider sweep, turning southwest and then nearly west, passing a little more than a mile south of Shwenksville, and so in a straight course to the Schuylkill, between Linfield and Sanatoga and some three miles below Pottstown.

The course of these comparatively hard beds is marked nearly everywhere by a decided ridge, particularly well defined between Ottsville and Sumneytown, and tunneled through at Perkasie. As the beds are partly green, their course is also indicated by the yellowish or greenish gray

color of the surface of the ground contrasted with the red on either side from the several thousand feet of red shales above and below, except where trap replaces them above for a long distance from the Haycock southwestward. The geological structure is also well shown by very numerous observed dips and strikes.

Here and there among the harder beds, exposures have been observed of a couple of blackish shale layers some three feet thick, perhaps identical with those of the boring. One was seen by the roadside near Rufe's Corner; two in a ravine a mile and a half north of Ottsville, where some digging was done half a dozen years ago in a vain search for coal of any economical value, though small traces of it appear to have been found; another exposure of blackish shales was seen half a mile west of Perkasie; and still another about a mile east of Harleysville.

It is, of course, extremely improbable that the beds with a known outcrop of about sixty miles in length, cut across by numerous streams and roads and by several railroads and even in great part by a tunnel, and familiar throughout every foot of its surface to the highly observant inhabitants of the country, could have a coal bed of any value that should never, until this well, have been discovered through any complete natural exposure or through an occasional very noticeable outcropping or blossom. Indeed, facts observable on the surface, such as measured rock exposures, combined with proper regard to their dips, strikes and relative position and elevation, could no doubt give a very complete section of all the beds pierced by the well; and perhaps that will prove to be possible even with the somewhat rough collection of materials already made. From such observations on the surface, the character and thickness of each bed is to be known far more precisely and thoroughly than could be possible from any boring however careful, and beyond all comparison with the results of an ordinary one. The difficulty of accurate information from such wells is shown by the doubt in the present case whether the so-called coal bed was nine feet in thickness or five and a half.

The well record, in spite of all the imperfections that must be expected, has value as giving for a great thickness of rock beds a connected view that may serve in some degree as a check upon the not very essential errors that might arise in combining surface observations, especially those rough ones hitherto obtained. But the chief importance of the record is perhaps as an illustration of how ready men are to lay out thousands of dollars for such explorations where the same number of hundreds would by a surface survey give fuller and more accurate information.

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## *Possible Sterilization of City Water.*

*By R. Meade Bache.*

(*Read before the American Philosophical Society, April 17, 1891.*)

It is an open question whether the characteristic acidity of the digestive fluids is or is not efficacious in destroying pathogenic germs entering the stomach. But it ought to be evident on both sides that neither extreme can represent the truth, even if the digestive fluids possess that general property. It is certainly, on one side, too much to assume that, not even in a perfectly healthy stomach, are those fluids sometimes capable of eliminating such germs from the system, and, on the other, that they are always, in sickness or in health, capable of performing that task. So little vitalized are micro-organisms in their resting-stages, that it is easily conceivable that, when masked by food and water, and when the human system is in a weak condition, many escape the possibly destructive action of the healthiest digestive secretions.

It would, additionally, be an unwarrantable assumption, even if the healthy stomach were proved to be able always to neutralize the morbific action of pathogenic germs, that they find their inevitable path and exit, with or without vitality impaired or destroyed, dead or alive, through the alimentary canal; for in point of fact we know that one kind, at least partially, takes its disastrous course directly into the lungs. When the infinitesimal size of micro-organisms is considered, and when also is considered how varied is the character of the parts with which they must come into contact upon passing the œsophagus, it will readily be perceived that, even if they escape the sometimes assumed destructiveness of the digestive fluids, they must often be absorbed into the blood by other tissues as well as by those of the lungs.

If so believing, we should perceive at the same time that it is hopeless to contend, except by palliative sanitary measures, against the invasion of pathogenic germs through inhalation; but that, on the other hand, especially as our food cannot be sterilized wholesale, we should deeply consider the possibility of contending with them by means of the wholesale sterilization of water, which enters alone, or as the largest constituent, into our

drink. That this has heretofore not been attempted is all the more remarkable, because it is believed by many persons that some of the worst forms of pathogenic germs reach us through the medium of drinking water. Inasmuch, therefore, as success in sterilizing the drinking water of a large city might be of untold benefit to it, it would be well that certain experiments were tried to that intent, upon the assumption that, be the pathogenic germs in a particular water many or few, they become, when received into the alimentary canal, whether or not large numbers of them are successfully dealt with by the stomach, injurious to the human economy.

Inherent in the Anderson iron process for the purification of water is a danger which, therefore, cannot be eliminated. In all processes there is a danger line which human foresight seeks to avoid by a safety-margin, which, in the long run, and in the nature of things, is a substantial guarantee against harm. But there are processes such, from their character, combined with the chapter of exigencies and the chapter of accidents, that they have but a small margin of safety. I place the Anderson process in this category, as an experience at Berlin, showing the danger that may result from the overworking and freezing, or both, of open filter beds, even if so acted upon and cleansed as they are intended to be by the Anderson process, fully warrants me in doing. Moreover, it should be incidentally mentioned that the process is not applicable to the constitution of all waters, or adapted to climates that have always, or are liable to, severe winter cold. It is said, however, upon excellent authority, based upon the indisputable evidence of microscopic examination, that by the process micro-organisms have, under the limiting conditions hereby implied, been neutralized in the proportion of 50,000 to about 20, virtually in the proportion of 50,000 to 0. But, coincidently with this result, which must obtain under favoring circumstances, there also always exists danger in the process through carelessness and neglect in filter cleansing, and necessity without law of overworking the capacity of a filter. As a finality in the process the ferric hydrate generated, blended with organic matter, is precipitated in a flaky, coagulated condition to the bottom of the water, the sand filter-bed of the settling reservoir, where, resting chiefly on the surface, the filter is therefore more readily than usual cleansed. The process therefore

makes no pretense to destroy the micro-organisms, but merely to neutralize as much as possible their injurious action in the human economy, simply by entrapping them. What I contend, however, is that the best process of sterilization is that which does not seek to entrap micro-organisms, with the inseparable danger of their partial or almost entire escape alive, but that which, with abstention from their purposive arrest, kills, and allows them as free passage as possible to the stomachs of city dwellers. It will probably be thought at this point, with a very usual misconception, as that which we have in the Anderson process has proved quite efficacious, whereas that of which I speak is but an ideal, perhaps impossible of attainment, that I am proposing to accept a shadow for the substance of a thing. I would grant the cogency of the thought, had I ever intended to make denial of the excellence of the Anderson process, and proposed to offer a possibility in exchange for a reality. But, having taken neither of these positions, I do but state the case in the abstract, and the truth of it in that form being admitted (and I do not see how it can be denied), I have but to add before proceeding that, excellent as is the Anderson process, within its acknowledged lines, it would still be well to consider if the ideal one is not capable of accomplishment by the means which I am about to suggest.

About two years ago it occurred to me that before experimenting with bacteria, with reference to killing bacilli established in the human body, and with reference to the sterilization of city drinking water by electricity, I would pass a current through some water containing protozoa, and observe how much is required to kill them. With this purpose in view I took a glass tube of four inches in length and five thirty-seconds of an inch in calibre, and partially filled it with water teeming with protozoa from hay-infusion, which had previously been examined by me under the high power of a one-tenth microscopical objective, commanding a large field with an immersion lens, and depending upon which of two eyepieces was used, magnifying from five hundred and fifty to six hundred and fifty diameters. When both ends of the tube had been plugged up with brass eye-screws wrapped with paper, leaving their ends exposed in the tube, the volume of infusion intervening between the ends of the poles thus formed was only two-thirds of a cubic centimeter, and the

distance between the poles only three inches. The electro-motive force at my disposal in my galvanic battery—only about thirty volts—was too small, and the resistance too high under these conditions for me long to hope to affect the protozoa in the tube by means of the current. The smallness of the volume of fluid in which the electricity could find play, and the liberation of hydrogen which could not escape or recombine, were together the cause of this; the resistance from the latter cause proceeding by great leaps when a higher current was eventually employed. With the infusion the resistance was far less than with pure water, but still far too great to allow of much current, owing in sum to the small volume of liquid and to the increased liberation of gas in it as compared with that liberated in water. The current was so slight that at this point of time I was satisfied that if I were not able thus to destroy the vitality of the protozoa—and that was proved by microscopical examination—*a fortiori* it was not to be imagined that the vitality of schizomycetes in water could be arrested, because I had assumed that they would be more difficult than the other organisms to destroy, a conclusion which I do not now think warranted by my final investigation upon the basis of experiment. I therefore desisted from experimenting, and did not resume it until the work of Dr. Griffiths on micro-organisms came under my eye, from which I learned that he had killed bacteria with a very small current in media of a fluid character. I then resumed my experiments upon the basis of my previously enlarged experience, that a considerable volume of water is needed for the play of electricity, and that even a slowly increasing bubble of hydrogen in a closed tube, although far from effecting embolism, nevertheless produces rapidly cumulative resistance. Every one who deals with batteries or who is well-read in electricity knows in a general way of these phenomena; I am merely referring to the exaggerated degree in which they manifest themselves under the specified conditions. I was well aware that for a given ampèrage, a given electro-motive force, a given character of liquid, a given temperature, and a given distance between poles, the resistance to a line of force of electricity is an absolutely fixed quantity. But as my final object, as will eventually be seen, was to charge a large volume of water so that upon being charged the electricity would concentrate with intense energy towards the opposite pole, it became

necessary, even in laboratory experiments, to avoid action where the phenomena appear in an exaggerated adverse form. I therefore next proceeded to deal with small but unconfined volumes of liquid.

With the Wheatstone Bridge, with an electro-motive force of one hundred and ten volts, and one ampère of current, I found the resistance at two inches between the poles, placed vertically in a hay-infusion, in a round glass dish about five inches in diameter, to be 1560 ohms. Making the liquid a little shallower, the other conditions remaining the same, the resistance rose to 2120 ohms. In a very narrow, rectangular receptacle, the other conditions remaining virtually the same, the resistance rose to 3000 ohms. The poles being then placed in water, not in the infusion, in the round glass dish, the other conditions being the same as those in the first experiment, the resistance became 18,400. Slightly increasing the depth of water in the dish, the resistance sank to 13,000 ohms. These rude experiments were followed by a series conducted with two beautifully finished wooden, shellaced boxes, of exactly the same length and depth in the clear, but one of them of only half the width in the clear of the other. Thus was obtained with precision in the larger of the two (but, of course, the same consequence would have ensued with the smaller), by alternately making it exactly one-half full, and then full to the brim, the result that the volume thereby vertically obtained reduces by one-half the resistance of the lesser volume. Thus, also, by filling both boxes to the brim was obtained with precision the result that double the volume of liquid horizontally obtained reduces by one-half the resistance of the lesser volume. Therefore it was demonstrated that resistance in water, as well as in metal, is inversely proportional to volume as determining cross-sectional area, whether increased by vertical or horizontal extension; that is, is inversely proportional to cross-section, as dependent upon volume; and that in whichever of these two directions volume is gained, it introduces, proportionally, freedom of propagation of the electric force in and about the imaginary right-line joining the poles.

The result of a series of experiments, with the poles placed apart at 2, 4, 6, 8, up to 12 inches, showed that the resistance, whatever it may be, varies *directly* as the distance between the poles, a result identical with that in electrically charged wire,

illustrating a law which should have been expected to hold good whatever figure and volume the lines of force between the poles might assume and occupy. The experiments clearly proved, too, that the resistance of water is very much greater than that of an infusion not seemingly dense.

There seems to be with some persons a belief that water is a good conductor, because current electricity so readily discharges itself by means of moistened surfaces. But current electricity so discharges itself through a film of water covering non-conducting surfaces in default of any other conductor whatever; and static electricity, for the same reason, readily vanishes through aqueous vapor, because of the fact that the vapor impairs the resistance of dry air as a dielectric. Yet electricity, in these two manifestations, acts thus, of course, not from choice but from necessity, taking, however imperfect, a path of conduction when there is no other, and the better of two paths when they differ, in proportion to their relative conductivity. Other persons imagine that water is a worse conductor than it really is. Any one who uses a hydro-rheostat well knows the highly resistant property of water to the electric current; but as free and in large volume it is not practically so resistant as it is sometimes thought to be, as any one may prove for himself by the rude experiment of plunging in an ample basin of water the sponge of one reophore of a medical galvanic battery, yielding from thirty to forty volts, while the sponge of the other reophore is placed on the back of the hand submerged in the water at the distance of four or five inches. The hand, the most callous part of the body except the heel, feels the current distinctly in every part, and if it has but the smallest abrasions of the skin in places remote from each other, the electric current makes them sting, finally condensing strongly at the pole on the hand.

After trying the experiments described, I flashed one hundred and ten volts through a glass tube, with half of a cubic centimeter of hay-infusion containing protozoa, with the poles half an inch apart; and also flashed one hundred and ten volts through a looped wire going from top to bottom of a small bottle containing four centimeters of the infusion. In neither case could subsequent microscopical examination detect that the organisms had been affected in the least. The whole of the current, of course, passed through the organisms in the tube. In the case

of those treated with the looped wire it was only the residual force, which the wire did not carry, that they encountered. That under these conditions the wire does not carry all the electricity is shown in the forthcoming description of experiments, in which the work of killing bacteria was successfully accomplished with looped wire passing through fluid media, and carrying only a very small force, but for a considerable time. With so much electro-motive force as I used—one hundred and ten volts—I could not allow the discharge through the micro-organisms to be more than momentary, else they would have been destroyed for certain by the concentrated products of electrolysis.

Two main conclusions seemed to me from the beginning of my experiments to be justifiable. The first of these was that, inasmuch as protozoa have no nervous system, and do not seem to be injuriously affectible by the electric current (barring its action under conditions such as generate heat almost exclusively), we are accustomed to think erroneously of the current as capable of affecting and endangering all sensation and life, solely because of our own possession, and knowledge of the possession among other animals, of a nervous organization upon which stress may be put by the current. It seemed to me that the last experiment proves what is currently believed, that an animal protoplasmic organism has, *ipso facto* of its being protoplasmic, no nervous system. The second conclusion at which I arrived was that, if protozoa of the kind with which I had dealt are not easily killed by the electric current, it would be hopeless to think of destroying schizomycetes, except by a force which, for the practical purposes that I had in view, it is impossible to apply to them, especially as, in the pleomorphic forms assumed by some of them, it is notorious that they possess latent vitality difficult to extirpate.

I am still inclined to hold to the first conclusion, as justifiable from my experiments as far as they have even now gone, that animal micro-organisms, submerged in water or any other liquid, are not susceptible to injury from electric current approaching in force the highest that I used (which may be regarded as prodigious when the minuteness of the organisms attacked by it is taken into consideration), and that perhaps they are not susceptible to injury under those conditions from any current, however high. But, as to my first conclusion, I have since found myself, upon reading the work of Dr. Griffiths, egregiously in error

through the false inference that I had drawn that, because the electric current did not destroy protozoa of the kind with which I was dealing, therefore bacteria would not be destroyed by it, at least within the bounds compatible with human life or well-being. It seems, however, that vegetable protoplasm, at least of the fungus kind, acts differently from animal protoplasm under the influence of the electric current. After reading the results of Dr. Griffiths, I gladly reverted to the intention with which I had set out in my experiments, of being able to suggest means by which bacilli forming a nidus in the human body could be destroyed and water supplied to cities could be sterilized for drinking purposes.

The author to whom I have referred is Dr. A. B. Griffiths, Fellow of the Royal Society of Edinburgh. He remarks that the full details of his experiments with electricity on bacteria are to be found in Volume xv of the Proceedings of the Society. In making the experiments he seems to have had no ulterior object in view but the gaining of information as to what amount of current would destroy certain micro-organisms. The wood-cut which he gives at page 177 of his work, *Micro-organisms*, represents a faradaic, not a galvanic battery, as the generator of the electromotive force used in his experiments. At the beginning of mine I used both the galvanic and the faradaic battery. The receptacles in which Dr. Griffiths placed pure cultures of different bacteria were simple, broad-based, short bottles, in which were fitted from top to bottom of each bottle a single loop of wire in free electric liquid communication with the micro-organisms. He does not in any case give the resistance in ohms of the media employed in the cultures.

The bacillus tuberculosis was killed by 2.16 volts, the bacterium lactis by 2.26 volts, and the bacterium aceti by 3.24 volts. The electric current was allowed to pass for ten minutes, and the temperature of the laboratory during the experiments was 16 C. (60.8 Fah.). In another series of experiments, bacillus tuberculosis was killed by 2.16 volts, bacillus subtilis by 2.72 volts, and bacterium allii by 3.3 volts. The current, as before, was allowed to pass for ten minutes, and the temperature of the laboratory was 17 C. (62.6 Fah.). In the first series of experiments no growths appeared from inoculation in fresh nutritive media, after an incubation of twenty-five days, with the thermometer at

38 C. (100.4 Fah.); and in the second series, similarly treated, no growths appeared after an incubation of twenty days, with the thermometer at 35 C. (95 Fah.). As before incidentally mentioned, all of these experiments were made with wire looped in glass bottles. Consequently all the electricity that attacked the microbes away from the wires was the residuum which the wires did not conduct, necessarily by far the lesser portion; and as the minimum of force was not sought or obtained, what is needed may be a mere fraction of the time and force actually employed. With so small a current as that used, and with the considerable volume of the respective liquids employed—which latter point the wood-cut shows—detriment to the organisms from products of electrolysis may be deemed inappreciable.

It has therefore been demonstrated that certain schizomycetes can be killed in a short time by a low current. Presumably all others can be killed in an equally short time by an equally low current; which was the assumption with which I had set out at the beginning of my own experiments, looking primarily to destroying pathogenic germs in the human body, and secondarily, to rendering them innocuous through the sterilization of water for drinking purposes. I therefore ask myself why, if a very low current, passing for a few minutes, can destroy bacteria in a bottle, should not a much higher one, administered repeatedly for the same time, be sure to destroy them in the human body? Daily, in the course of electro-therapeutic treatment, ten, twenty, twenty-five, and many more volts are administered to patients, avoiding only strong or continuous application of the current to the pneumogastric nerve, on account of the inhibitory action of the heart thereby provoked. But I will not pause just at this moment to speak more fully to this point, but will here confine myself to the main subject of this paper, clearly set forth by its title and the tenor of the preceding remarks. Reverting to the question of the sterilization of water for the use of cities, and with the new light upon the subject, which, as it appears, I might have gained for myself, but for having been diverted from my course by a false inference, I am constrained to ask my hearers, as I have asked myself in this case also, why the attempt should not be made to destroy bacteria wholesale in the drinking water of large cities by the method previously foreshadowed.

The means at our command seem to me ample. It is true that

we cannot electrolize successfully a large reservoir of water, for in that the electricity would be too diffused to be effective. It is true that, in pipes from which water is flowing into or out of the reservoir, its germs would not be subjected to attack for more than a second. It is true that the resistance that we should have to overcome in water would be large. But, on the other hand, it is also true that the electric current that we have at our command is capable of indefinite increase. The electro-motive force of a few thousand volts (there are dynamos that generate ten thousand) thrown athwart a pipe of proper dimensions, would probably paralyze every bacterium in its path, more than compensating by force for slight duration in time as compared with the ten minutes adopted in the experiments of Dr. Griffiths, as to which it is imperative to remember that they did not determine either the amount of current, or of time required, for the destruction of the bacteria experimented upon; and, consequently, it will be observed, both force and time needed are probably very much less than his experiments on their face apparently demonstrate.

If lines of water-delivery as well as those of water-supply were subjected to the attack of the electric current, the severity of it would be more than doubled for the organisms. It would be immeasurably increased in severity; for experiments at the very beginning of bacteriological investigation clearly showed that the best mode of destroying bacteria involves the principle of repeating relatively moderate attacks upon them at intervals such as find them partially recuperated, and assail them in this the period of their least resistant vitality. The method to which I allude is that of repeated boiling of slight duration at moderate intervals of time. That they can bear this apparently severe process at all shows the protective influence for them of any fluid immersion within the chemical character that does not wholly ignore the difference of habits among their different species, and water seems to be a medium inclusive of them all. The principle involved in the mode of attack mentioned is the same as that involved in the mode of destroying bacteria here suggested. Taking it in connection with the facts that a reservoir represents a large volume of water, only a part or a few parts of which are being momently drawn upon for supply, and that many germs are constantly passing through natural phases of relatively less vitality, infinitely below that in which they, if

pathogenic, being received into a favoring host, so vigorously form ptomaïnes, to their self-destruction as well as that of the host, it would seem that, if upon issuing from as well as upon entering a reservoir, the water were attacked in pipes from poles all but encircling them, with an electro-motive force of a few thousand volts, all germs must reach the denizens of cities supplied from such a source, wholly innocuous, because they would be dead.

It need hardly be said that, if the poles were placed opposite to each other on a heavy metal pipe conveying water, the electricity, seeking lines of least resistance, would not pass through the water at all, but around it, through the great mass of the pipe. But it should be obvious that it is easy to adapt to the place of electrical attack of a pipe a simple contrivance consisting of a section of the same diameter as that of the pipe, insulating the poles from each other, and both from the general line of the pipe. A plan that might at the first blush appear to some persons better, as not entailing thus radically breaking the continuity of the main pipe, would be to have two series of metallic insulated screws, representing by position two opposing arcs, the individual screws of which should enter and pass through corresponding holes in the pipe, the ends of the screws being uninsulated. But this plan would not do at all. The experiments described have proved the resistance of water to be so great that a large volume of it is required for electricity to pass easily through it. Consequently, in overcoming the resistance of water in a metal pipe with poles attached, in the form of insulated perforating screws, part of the electricity would, in making large excursions, be received and conducted to the poles by the metal of the pipe, instead of reaching them entirely through the water. But, if the pipe were interrupted by a non-conducting section, of length to be determined by the diameter of the pipe and the electro-motive force to be used, then those excursive lines of force would eventually fall into the determinate direction of the poles entirely through the water. We see this action clearly illustrated in the previous experiment, where, in open vessels, resistance to the current rapidly diminishes as we increase the volume of the liquid. We see the same thing also clearly illustrated in the case of the hand submerged in the ample basin of water, where the remotest abrasions of the skin

sting from the current, finally emerging with condensed force at the pole resting on the submerged hand. In a pipe with a properly calculated non-conducting section, the lines of force would play freely inside of the pipe, occupying and limiting there a rounding imaginary space, varying in figure with every change of force, but always, of course, having its apices at the poles, approaching which, and especially at which, would be concentrated their intensest energy.

If the full significance and legitimate outcome in conclusion from the experiments that have been detailed have been perceived, it will have been realized that, although water acts like wire with reference to conductivity, through length, cross-sectional area, and temperature—exemplifying the law of conduction by and resistance to the electric current, with reference to volume, however disposed—the difference between wire and water, notwithstanding that metal has great conductivity and water very little, is enormous with reference to difference of capacity. We have but to determine, first of all, what electromotive force is needed for the purpose of destroying germs in water, assuming that they are thus destructible, and then, upon that basis, determine what the length and cross-section of non-conducting pipe should be to accumulate and discharge the force required. One could charge a constant stream of water in an insulated pipe as never wire nor any congeries of wires nor any metallic deposit on earth could be charged with electricity; for whereas all these would soon reach their utmost capacity for localized energy, an insulated flowing pipe has back of it all earth ready to receive and effectively return the force transmitted. We, however, need for our purpose at most only a small area of that vast space. But yet it is true, and a striking exemplification of the stated fact that, given a dynamo of far less than infinite power, with poles astride an estuary's living stream, so wide, so deep, that the earth there would not fuse before a fiery blast engendered by resistance, and connected as those waters are with every drop in every brook, the encircling oceans, and the interlying land, it would send its impulse thence over the whole uninsulated globe, and backward, in myriad lines of force, with all but synchronous and omnipresent thrill.

I stated at the beginning of my discourse that it is an open question whether or not the stomach is capable of destroying

pathogenic germs. In that, of course, is involved the other open question, whether or not ordinary drinking-water is the source of disease. I have properly spoken of the questions as open ones, because so many persons are enlisted on opposite sides that I cannot venture without arrogance to decide them authoritatively. The tenor of the preceding remarks, however, must indicate that, personally, I believe drinking-water supply to be ordinarily one of the largest factors in the causation of some zymotic diseases; but lest I may have left it in doubt that I hold that view, I here state it explicitly. I have, I confidently believe, pointed out one way in which the evil may be abated, and perhaps neutralized; and this without disparagement of the efficiency of subsidence basins in their adverse influence upon bacterial dissemination. As to this (with the exception of treatment with iron) the last remaining factor in the production of pure drinking-water, I shall be glad to take a more opportune time than the present occasion, when I have so long engaged the attention of the Society, to prove directly, from my still later experiments and observations, what seems directly proved by the statistics of prevalence of typhoid fever in Philadelphia and elsewhere with reference to areas of different water-supply, that subsidence basins are also an important factor in the health of a city, not only relieving water of impurities in it, represented by alluvial and effete matter in suspension, but also relieving it in a measure of the impurity due to simultaneous deposition of the bacterial bearers of poison to our homes.

As to our ability to destroy the bacillus tuberculosis in the human body, by means of percutaneous administration of the electric current, I hope that I may be allowed to say a final word. I cannot see, as I have already remarked, why, if it can be killed in a bottle with a mere fraction of two volts (as I have shown by the experiments of Dr. Griffiths that it must have been killed), it cannot be killed in the patient suffering from tuberculosis, by the enormously greater electro-motive force that the body is capable of receiving without detriment in a concentrated form. This statement, however, is not intended to imply that the current would be capable of curing a case of tuberculosis which had involved caseous degeneration of the parts. If it did, it would also imply that to my mind electricity is creative. Electricity, however, although not creative, includes

among its manifold and marvelous properties not only dynamic power, but attributes regenerative of vitality, and with these two it is capable, if the experiments of Dr. Griffiths are to be relied upon, of killing the bacillus tuberculosis in the living human body, in case the lesions of the disease have not seriously impaired electric conductivity in the parts morbidly invaded; and capable also of contributing to restore healthy function to them, and thence normal structure. It remains for physicians to make the essay here indicated at no expense or risk whatever. If the treatment prove to have any virtue in it, it would apply to other bacterial diseases besides tuberculosis.

In regard to the essay with reference to the sterilization of drinking-water, experiments could be made at no great labor and expense compared with the vast interests at stake in a large city. Through microscopic tests would soon be set at rest the question as to whether to any, and if to any, to what extent germs could, by the means described, be destroyed in city water, and scrutiny of the health of the city, within the lines especially of certain diseases, through comparison of present with past records, would in successive years have its own independent and conclusive tale to tell. I pledge Philadelphia prospectively in a bumper of pure water more worthy of celebration than the best Falernian wine.

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*Obituary Notice of P. W. Sheafer. By J. P. Lesley.*

(*Read before the American Philosophical Society, April 3, 1891.*)

Peter Wenrich Sheafer was born at Wiconisco, in Dauphin county, Pa., March 31, 1819. His father, Henry Sheafer, was afterwards President of the Lykens Valley Railroad Company, and Superintendent of the Lykens Valley Coal Company, mining the finest quality of anthracite coal, at the west end of the Southern Anthracite Coal field. The discovery of the Lykens valley coal bed in the body of the Pottsville Conglomerate was one of the astonishing incidents of Pennsylvania geology, and enabled the Sheafers, father and son, to establish a great trade in anthracite coal upon the line of the Susquehanna river as far as Baltimore.

Peter Sheafer was engaged at various times in his long professional life in following the outcrop of this interconglomerate coal around the edges

of the Southern and Middle fields, but without finding it in an equally good condition in any other parts of the region. He often expressed to me his hopes and his disappointments regarding it. It was but an episode in his career, for his large fortune was chiefly accumulated by the purchase and exploitation of the Mammoth and other large beds overlying the Conglomerate.

After leaving school, Peter took a full course at Oxford Academy, New York, with the object of a better geological acquaintance with coal and coal mining. But at that early date, the science of geology could hardly be said to exist. In 1835, the New Jersey and Virginia State surveys, and in 1836 the Pennsylvania survey, were begun. Prof. H. D. Rogers' first assistants were Mr. Booth, afterwards the chemist of the United States Mint, and Mr. Frazer, afterwards Professor of Chemistry in the University of Pennsylvania. The following year, Mr. Trego, Mr. McKinney, Dr. Whelpley, and others were appointed assistants on the survey. In 1838, Peter W. Sheafer received his commission, while Dr. Whelpley had charge of the Southern and Middle field, and Mr. McKinley of the Northern field. Henderson and I were the next year Whelpley's aids, and I saw little or nothing at that time of Peter Sheafer, who was busy with his own part of the field work, and was laying the foundation of that accurate knowledge of the order and quality of each coal bed which enabled him afterwards to make himself easily the principal practical mining engineer of the anthracite region. His mind and the training of it was just suited to this work of his life. He had good judgment, inexhaustible liking and ability for work, a retentive memory, a quick eye for money values, a peaceable disposition, great caution in undertaking, and pertinacity in accomplishing the exploitation of properties. He made himself personally acquainted with everybody and everything that happened or was likely to happen in the anthracite world, and kept himself in constant intercourse with owners, investors, speculators, mining prospectors, engineers, and railroad companies; and, what was the key to his fortune, never rode hobbies, or allowed himself to be turned aside into other pursuits; although at various times in his life he traveled far to examine and report upon distant coal fields for those who employed him as a professional adviser. I have known, also, of his reports on iron-ore properties and oil and gas lands. He was also a great collector of statistics, and was the first to conceive the idea of a statistical coal pagoda, with lines drawn across it at regular intervals to represent successive years, the old legendary 365 tons of anthracite sent to market the first year forming the apex of the pagoda, and its successive stories, bulging or being overhung according as the anthracite market received a greater or less addition to its ever-swelling volume of trade. He was for many years the recognized authority for the statistics of the region.

In 1848, he married Miss Harriet Whitcomb, of New England, and set up his home and office in Pottsville, the capital of the anthracite country. For forty-three years this has been his happy, hospitable, and elegant

residence, and here his children, Louise, Arthur, William, and Harry were born and educated, his sons becoming partners in his enterprises, sharing the toils, the responsibilities, and the wealth of their father, and fitted well to maintain the honor of his name.

In 1850 Peter Sheafer took an active and influential part in the effort inaugurated by William Parker Foulke of Philadelphia and other gentlemen to obtain an appropriation from the Legislature for publishing Prof. H. D. Rogers' Final Report on the Geology of the State. Half of the appropriation was to be spent in field work, to bring the Report up to date, especially that part of it which related to the anthracite coal fields. Mr. Rogers formed a corps, consisting of Peter Sheafer and his cousin, John Sheafer, for underground surveys; myself for surface topography; Edward Desor, of Neuchatel, for the study of the surface deposits, and Leo Lesquereux, of Columbus, O., for the study of the coal plants. This work only lasted one year, and this corps was disbanded, but a good deal of special work was done in the following year or two in other parts of the State; and the Report did not appear until 1858.

At the organization of the Second Survey of the State, in 1874, Peter Sheafer's business interests were too exacting and important to permit of his taking an active personal hand in it, but he did all that he could to further the interests of the survey at Harrisburg and elsewhere through the following fifteen years of the continuance of the survey; and I am happy to say that the intimate friendship which he and I formed in 1851 was confirmed and continued with unabated cordiality to the present time. His son Arthur was commissioned as Mr. Ashburner's assistant in the long and difficult survey of McKean, Elk, Cameron, and Forest counties, where he exhibited great abilities for field and office work inherited from his father; and the greatest part of the "Report on Elk County," with its illustrations, is from Arthur Sheafer's own pen.

Peter Sheafer was a genial and lovable man, a religious man, and, what always struck me as very interesting, a man of poetical temperament, and a reader of the poets. But he was never properly trained to express his thoughts in a style of elegant composition. His business writings were unexceptionable. His statements of business facts and contracts were satisfactory, but he was unused to a logical, consecutive, well-systematized and picturesque presentation of a subject. This is, of course, to be ascribed to his lack of youthful classical training. I have often thought of him as that one of my friends whose life career best illustrated the advantages and disadvantages of college discipline. For by not going to college he gained more than he lost, and enjoyed great worldly and social prosperity at the very small cost of missing literary facility. I even doubt that the lack of technical school training in his profession as civil and mining engineer was at any time an obstacle in his path of life. He learned enough to join his experienced father in earlier enterprises; and in after ones his intercourse with business men and technical books and

professional experts supplemented his own experiments and kept his intellectual ability abreast of the public needs of each succeeding year.

My friend Sheafer was a silent man, I should say reticent, always smiling and cheery in conversation, but seldom or never allowing even to his enthusiasm more than a momentary flash of expression. He had the confirmed habits of a good listener; and what he himself had to say was said in the fewest words the theme permitted or the occasion demanded. He was intently sympathetic, and loved to hear others talk; his own contributions being chiefly made in the shape of facts. No man better appreciated those whom he loved or respected, and this he owed to his poetic temperament.

One of the best instances of his ingenuity is his successful device for gobbing up a mine by boring down to its heading from the surface and causing a stream of water to carry down the bore-hole the fine slack or braize coal from a neighboring dust-hill. The coal-mud thus introduced into the abandoned workings is banked back behind loose brattices which let the water flow through but retain the mud, which in some months becomes solid and firm enough to hold up the roof; and then the workings are reopened and the mine is robbed of its pillars. The coal usually lost by the crushing of the pillars is thus saved without danger to the miners; and the country is also saved from caving and settling; which entails a further profit, inasmuch as the coal beds above the one worked out are preserved intact for future mining. Schuylkill county ought to erect a statue to Peter W. Sheafer for this invention alone.

He became a member of the American Philosophical Society, July 17, 1863. He was a member of the Academy of Natural Sciences of Philadelphia, of the Historical Society of Pennsylvania, of the American Institute of Mining Engineers, and of the American Association for the Advancement of Science. His philanthropic feelings induced him to become a member of the American Colonization Society.

His death took place at Brown's Mills, Burlington, N. J., to which he had been taken from Atlantic City in the hope of saving his life, and he was buried at Pottsville, March 31, 1891.

He was six months my senior in age; and now I remain the last one of that old set of the first geological survey of our State. They are all gone—H. D. Rogers, Booth, Frazer, McKinney, Trego, Holl, Boyé, R. E. Rogers, Haldeman, Whelpley, Hodge, Jackson, Henderson, McKinley, Sheafer—not one lives to tell the adventures of those early days of our science, when the very foundation principles of it had to be laid, and the physical constitution of Pennsylvania had to be discovered, without experience and without instruction. The bare outlines of the story have been told; but the individual life of that story will never be told; is, in fact, untellable.

### *Artesian Well in Lowest Trias at Norristown.*

*Notes by Prof. O. C. S. Carter.*

(*Read before the American Philosophical Society, May 1, 1891.*)

Drilled in the Trias of Norristown, near Stony creek, for water for steam boilers.

| | | |
|---|---|---|
| 15′ | Made ground.....to | 15′ |
| 23 | Sandstone, light colored, coarse grained, containing fragments of orthoclase feldspar..... | 38 |
| 33 | Sandstone, dull red, fine grained, with specks of muscovite. Color due to iron oxide..... | 71 |
| 31 | Sandstone, light pink (produced by pink orthoclase), fine grained; quartz grains transparent; fine specks of muscovite mica..... | 102 |

Water was struck every ten feet down to 70; none thence to 90; abundance of water between 70 and 102 (located by the driller at 95, 100 and 102); cased at 18 with 6 inch pipe ($5\frac{3}{8}$ inside). Steam pump furnished 1003 gallons per hour. After pumping 4000 gallons, the level of water in well fell 12 feet; after 7500 gallons, it fell 16 feet and stood.

Analysis of well water gave 11.8 degrees of hardness, as compared with 6 degrees for Schuylkill river water; 14 degrees for English surface New Red water (Wanklyn); and 17 degrees for English deep well, New Red water.

The lime exists mostly as carbonate, with some sulphate, and probably comes from the cement between the sandstone grains.

Another artesian well, situated within a hundred feet of this one, gave water which precipitated in the boilers a fine white powder of carbonate of lime, which did not cake and was easily blown out. This well water is therefore as useful in steam boilers as is Schuylkill river water; and is better, because it holds no mud or sand in suspension. A little soda neutralizes the sulphate of lime. The water also becomes perceptibly softer after continued pumping.

### *Artesian Well in Lowest Trias, at Norristown.*

Well drilled about half a mile from the Trenton limestone, which outcrops at Mogee's Station, on the Schuylkill river, to obtain water for the manufacture of artificial ice.

Cased at 28 feet with 6 inch pipe.

| | | |
|---|---|---|
| 30′ | Sandstone, very white and fine grained, containing a little pink orthoclase.....to | 30′ |

| | | |
|---|---|---|
| 5′ | Sandstone, white, containing coarse fragments of orthoclase. | 35′ |
| 6 | Shale, dark red | 41 |
| 14 | Sandstone, white, containing muscovite mica | 55 |
| 10 | Sandstone, lighter color, more feldspathic | 65 |
| 3 | Sandstone, very white, fine grained | 68 |
| 6 | Sandstone, dark red, coarse, containing much iron oxide and a little mica | 74 |
| 4 | Shale red | 78 |
| 18 | Sandstone, red, fine, micaceous | 96 |
| 4 | Shale red | 100 |

Water was first struck between 35 and 40. More than ten "crevices" [probably water cracks] passed between 35 and 100. The water now rises to within 16 feet of surface. Steam pump delivers 1500 gallons per hour. After ten hours' pumping the water falls only 10 feet in well, the whole fall occurring, however, in the first 45 minutes. With an improved pump 3000 gallons per hour were obtained.

*Water Well in Lowest Trias, at Washington Square, Montgomery County.*

| | | | |
|---|---|---|---|
| 22′ | Sandstone, red, micaceous | to | 22′ |
| 12 | Clay, stiff, red | | 34 |
| 1 | Shale, red (*Trias*) | | 35 |

Water first struck at 16 feet; a crevice every 3 or 4 feet; stands at 11 feet from the surface, and never falls lower, no matter how much is pumped, at the rate of 1500 gallons per hour.

*Artesian Well in Trias, in Worcester Township, Montgomery County, Pa.*

Drilled on the Duffield farm, on the north bank of Stony creek, at the crossing of the Stony Creek Railroad, between Custer and Belfry, through New Red (Trias) red shale and clay slates, some of them blackened with coaly matter.

| | | | |
|---|---|---|---|
| 20′ | Clay slate, gray, hard; little mica | to | 20′ |
| 5 | Clay slate, *blackened* with coaly matter | | 25 |
| 5 | Shale, red | | 30 |
| 5 | Clay slate, dark, fine grained | | 35 |
| 5 | Clay slate, very *black*, hard, compact | | 40 |
| 3 | Shale, red | | 43 |
| 2 | "*Quartzite*" | | 45 |
| 3 | Clay slate, gray | | 48 |
| 17 | Clay slate, compact, hard | | 65 |

The *quartzite* was said by the driller to be so hard that he could only drill six inches of it in ten hours.

Water was first struck at 38 ; again at 65 ; nowhere else. Water stands at 15 feet of the surface ; yields 60 gallons per hour ; drops 25 feet after pumping 6 hours.

Evidently the Stony creek water soaks slowly through the bed planes between the clay slates.

*Artesian Well in Lower Silurian Limestone, in Montgomery County, Pa.*

Drilled on Charles Kunkle's farm, south side of the Valley Green road, east of the Bethlehem pike, north-northeast of Flourtown.

| | | |
|---|---|---|
| 40′ | Limestone, not micaceous. ..... to | 40′ |
| 20 | Limestone, micaceous..... | 60 |

Water first struck at 40′ ; depth of well 60′ ; several small "crevices ;" water stood at 35 feet beneath the surface, and was not lowered by steam pumping 500 gallons per hour.

*Artesian Well in Lower Silurian Limestone, at Parkesburg, Pa.*

*By Prof. J. P. Lesley.*

Mr. P. H. Gibbons, Vice-President of the Parkesburg Iron Co., at Parkesburg, Chester county, Pa., was good enough to furnish me by letters dated January 1, February 9 and February 11, 1886, with fragmentary notes of the boring, and forty-five samples for examination, which I have in bottles, the depth in feet recorded on the corks, and finely powdered specimens on glass slides for microscopic use.

| | | |
|---|---|---|
| Soil, first passed through..... | | 18′ |
| Limestone struck..... | at | 20 |
| Quicksand encountered..... | at | 23 |
| Cased quicksand out. ..... | at | 24 |
| Limestone ("bastard "), more dense and solid. ..... | to | 42 |
| Quicksand again..... | at | 42 |
| Limestone..... | to | 53 |
| Quicksand, with flow of water..... | at | 53 |
| Limestone, purer..... | to | 92 |
| Sandstone, yellow, fine grained, 7′ thick..... | to | 99 |
| Limestone, of varying qualities, sometimes sandy, "then mica, then lime or marble ;" no water. ..... | to | 174 |
| Limestone, of varying nature..... | to | 522 |

*Specimens examined under the lens, at the following depths :*

27′ Resembles a sandstone, light gray, with white fracture, some quartz crystals and a show of mica.

32 Same as above, with a trace of iron oxide.

34′ Same as above, with an increase of mica.
37 Same as above.
48 Same material, but blackish gray.
60 More carbonate of lime, and some mica ; reddish crystals, peroxide of iron.
69 Large percentage of carbonate of lime.
79 Limestone.
90 Limestone.
95 Quicksand, yellowish white.
99 Same as last.
102 Limestone ; mica and quartz in quantity.
117 Limestone, reddish.
123 Limestone, bluish light gray, mica.
150 Limestone, with yellowish red crystals.
171 Limestone, white, fine grained.
179 Same as last.
194 Same as last.
208 Limestone, grayish white.
227 Same as last.
239 Same as last.
255 Same as last.
268 Same as last.
282 Same as last.
288 Limestone, hard, and fine grained, light gray, white.
302 Same, increasing in hardness.
308 Same as last.
324 Same, gray and white ; show of mica.
332 Same, darker gray ; more mica.
347 Same as last.
360 Same, bluish gray ; coarse granules.
372 Same as last.
387 Same as last.
404 Same, granules finer ; show of mica.
415 Same, grayish white, still finer ; less mica.
422 Same as last.
433 Same, dark gray, mica, iron.
448 Same, more crystalline (rhombohedral); more mica.
455 Same, crystalline, dark gray.
464 Same, crystalline, gray and white.
472 Same, fine crystals, light gray.
486 Same, finer granules, very hard ; with mica.
502 Same, perfectly crystalline ; more mica and feldspar.

One slide prepared to show crystalline forms.

The occasional dissemination of minute flakes of mica and fine grains of feldspar through the limestone is better evidence of the deep-sea

deposition of these Ordovician or Lower Silurian limestone beds than is the silica in quartz form which they contain.

The beds are highly tilted to the south; therefore the vertical hole exaggerates the thickness. The formation is probably "Calciferous" *No. IIa*, but no fossils have been found just here. No record of water obtained.

*Artesian Well in Potsdam Sandstone, in Montgomery County, Pa.*

*Notes by O. C. S. Carter.*

Drilled on William Janeas' property, near Williams Station, at the crossroads, south of Lancasterville, and east of Spring Mill, the Plymouth Railroad sweeping around it on the southwest.

| | | |
|---|---|---|
| 64′ | Sandstone (*Potsdam No. I*), coarse ..... to | 64′ |
| 6 | Sandstone, fawn colored, micaceous..... | 70 |
| 10 | Sandstone, light brown, fine..... | 80 |
| 10 | Sandstone, coarse, micaceous, transparent quartz. .... | 90 |
| 22 | Sandstone, fine, micaceous..... | 112 |
| 6 | Sandstone, very coarse, larger fragments of quartz, with red iron stains. ..... | 118 |
| 4 | Sandstone, coarse ..... | 122 |
| 4 | Sandstone, fine, grayish brown..... | 126 |
| 4 | Sandstone, coarse, fawn colored. ..... | 130 |
| 2 | Sandstone, fine, resembling ground ginger. ..... | 132 |

No conglomerate like that of the Willow Grove Potsdam outcrop passed through; beds tightly laid so that water crevices were few and insignificant. No water struck until the drill reached 80. Water rose and stood at 70. Steam pump delivered only 300 gallons per hour; water falling 10 feet after pumping 10 hours.

*Artesian Well of Chalybeate Water, in Chester Valley Clays, near King of Prussia, Montgomery County, Pa*

*Notes (condensed) of Prof. Oscar C. S. Carter.*

Drilled on William Thomas' land; 90 feet deep; water, deep brown (cider) color, even after 30,000 gallons had been drawn by a steam pump in three days; bubbles of carbonic acid gas constantly escaping; water not clear after standing several days; precipitate, analyzed, was carbonate of iron; precipitation not complete after a week.

| | | |
|---|---|---|
| 35′ | Yellow clay.....to | 35′ |
| 10 | Layer of rounded pebbles of white quartz, resembling those on the sea shore..... | 45 |

10′ Fine white sand and pebbles..... 55′
10 Blue clay, holding iron balls..... 65
10 Fine yellow clay, holding iron balls..... 75
Thin bed of solid sandstone which seemed to be *Triassic*, perhaps not *in situ*.
5 feet of Chester Valley limestone (no more limestone) 80
Struck top of *Potsdam S.S.*..... at 90

*Water* first struck at about 40′ down; at first, muddy; soon cleared on standing; supply soon exhausted by the pump; merely surface water.

No more water until depth of 81′.

*Chalybeate water* at 81′; immediately rose in the dry well to within 32′ of surface. Pumped this water, 60,000 gallons, during 5 days (steam pump). Then iron water exhausted, and clear water took its place. Iron water evidently came from clay beds holding iron balls; some of which were brought up by the drill. Well cased (6″ iron pipe) to 83′.

Water stratum evidently lies between the clays and the rock floor.

### *Artesian Well in the Mica Schist of Philadelphia.*

### *Notes by O. C. S. Carter.*

Drilled by H. W. Kelsey, of the Oriental Bath Co., 1104 Walnut street, Philadelphia, for the supply of the baths.

Drillings at every 10 feet examined under a lens; elements arranged below in order of their abundance in the specimen pumping. No rock seen except mica schist and gneiss. Only *traces* of feldspar noticed above 170. Colorless muscovite mica makes all the strata nearly white from 160 to 210. The biotite mica darkens the strata from 210 to 266. *No hornblende seen in any of the pumpings.*

20′ Clay, the Philadelphia brick clay.....to 20′
46 Gravel (thin layer of clay at bottom)..... 66
34 Mica schist; milky quartz, biotite mica, occasional speck of muscovite mica, no feldspar..... 100
20 Mica schist; muscovite mica and trans. quartz ..... 120
10 Mica schist; biotite, quartz and muscovite..... 130
10 Mica schist; quartz, muscovite, some little biotite.... 140
10 Mica schist; biotite, quartz, some little muscovite.... 150
10 Mica schist; coarse fragments of quartz and muscovite. 160
10 Gneiss; coarse fragments of pink orthoclase, muscovite and quartz; *first appearance of feldspar*..... 170
10 Gneiss; quartz, orthoclase feldspar and muscovite.... 180
10 Gneiss; muscovite, quartz, biotite, little feldspar..... 190
10 Gneiss; muscovite, orthoclase and quartz..... 200
10 Gneiss; muscovite, orthoclase and transparent quartz 210

| | | |
|---|---|---|
| 10′ | Mica schist; quartz, biotite, muscovite | 220′ |
| 10 | Mica schist; biotite, quartz, muscovite | 230 |
| 20 | Mica schist; biotite and quartz | 250 |
| 15 | Mica schist; biotite, muscovite, quartz | 265 |

Few crevices; strata tightly packed; first rock water struck at 120; rose to 28′ beneath surface; pumped 5 quarts a stroke, 80 strokes a minute, 6000 gallons an hour; level falls 20′ after one hour's pumping.

Water a little hardened by sulphates and some iron.

*Artesian Well in Mica Schist, near Radnor, Delaware County, Pa.*

*Notes by O. C. S. Carter.*

Drilled on M. Wheadley's farm, in Chester county, Pa., in the *hydromica schist* of the South Valley Hill belt.

| | | |
|---|---|---|
| 30′ | Sharp white quartz fragments | to 30′ |
| 58 | Schist, very micaceous, silver gray, soapy | 88 |

Water crevices struck at 70 and 85; water rose only 10 feet in the well, and stood at 70 feet below the surface; yield, only 120 gallons per hour; drops 5 feet after pumping five hours.

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*Feldspar Bed in Laurentian (?) Gneiss.*

*By Prof. Oscar C. S. Carter.*

(*Read before the American Philosophical Society, May 1, 1891.*)

The feldspar quarry is opened on the east bank of the Schuylkill river, between Lafayette Station and Spring Mill, where the Reading Railroad (Norristown branch) and the Pennsylvania Railroad (Schuylkill Valley division) run side by side under the bluff outcrops of syenite and gneiss supposed to be of Laurentian or Archaic age, bordered on the south by C. E. Hall's Chestnut Hill Mica Schist belt of undetermined age.

A small stream cutting down into the Schuylkill just south of the quarry marks the contact of the mica schist and syenite and gneiss belts. About 100 yards north of the quarry is the granite vein described in Prof. H. D. Roger's *Geology of Pennsylvania*, 1858.

The county road runs between the railroad tracks and the bluff, and the feldspar bed is quarried for 35 feet alongside of the road. The feldspar

is also exposed between the road and the railroad for 10 feet more, making the bed at least 45 feet broad; the highest point of rock exposed is 15 feet above the level of the county road.

The dip of the feldspar bed is northward (40°) beneath the gneiss.

The direction of the feldspar bed does not conform to the strike of the belts of gneiss, but, on the contrary, is transverse, *i. e.*, nearly north and south.

The feldspar is orthoclase, of light pink color, with an occasional streak of white granular quartz running through it. Some of the large masses quarried out contain considerable quartz. Large masses of biotite mica are occasionally met with in quarrying; but the occurrence of biotite is not general through the rock.

The quarry was opened in the summer of 1886, and about 30 tons taken out and sold to the potteries at Trenton, etc. It is the only feldspar quarry in Montgomery county. The quarry in Delaware county is described in the Annual Report of the Geological Survey of Pennsylvania for 1886. A few others, in the States of Delaware, New York, Connecticut, Massachusetts and Maine furnish all the feldspar manufactured into pottery in the United States, the total production from all the quarries, from 1882 to 1887, having been 14,000; 14,100; 10,900; 13,600; 14,900; 10,200 tons, valued respectively at $70,000; $71,112; $55,112; $68,000; $74,500; $56,100. The crude feldspar is valued at the Trenton potteries at about $5 the long ton; and the pulverized feldspar at $11; the quartz being carefully separated out.

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## *A Fragment of Objectionable University-Extension Teaching.*

*By R. Meade Bache.*

(*Read before the American Philosophical Society, May 15, 1891.*)

It need hardly be said, and yet, to obviate the possibility of misinterpretation in outside quarters of that which I am about to remark, it becomes necessary formally to declare that I have no intention to depreciate the cause represented by the well-concerted effort of University-Extension teaching to disseminate knowledge heretofore confined to the comparatively few. I could heartily wish that my theme admitted of no mention save of generalities, but thus treated it would not subserve the interest which I would gladly promote, by being brought home to the

minds of my hearers, upon whose individual influence partially rests the benefit which University-Extension teaching is capable of effecting. The attempt to correct incidental error is strictly correlated to endeavor to promulgate the truth, and if it be wise to seek to sow intellectual seed broadcast, then it must also be wise to select it carefully, and to eradicate the tares if any should appear, especially if the soil be virgin, possessing little previous vigorous growth to maintain itself against invasion of injurious crops that haply may be introduced and appear as fruitage of the untried field.

I was present on the evening of the 16th of February l t, at Association Hall, in this city, at the lecture of Prof. Richard G. Moulton, of Cambridge, England, on Dumas' *Monte Cristo* as a companion study to *Prospero*, and there heard his attempt at the demonstration of psychical analogies, similar to those which his Syllabus for other occasions included, between the respectively preternatural and supernatural elements in *Monte Cristo* and *The Tempest*. Yet, although I am a monist, believing that all existences, whether religious, philosophical, or scientific, form one intimately connected and coherent whole in nature, the sole barrier to the just and complete comprehension of which condition lies in the feebleness of the human intellect, I also believe that, perforce of that infirmity, we are constrained to view things in the strictest categories, and that we judge of them only more or less clearly by rigid comparison of their immanent likeness and unlikeness; and hence, although, as was said of Dean Swift by one of his lady-loves, he could write well if he chose to about a broom-stick, it is not, in my view, philosophically permissible to any one to take a broom-stick for a rational flight, and from its suggestion superpose a witch, and with her scale the empyrean, opening up to vision all earthly things below in a maze with relation to themselves and the outspreading heavens.

If by accident, and it was of the purest, for I was invited, and did not go of my own motion to hear Mr. Moulton, some of his teachings have become my text, so much the worse for him, or mayhap for me, if I should meet dissent from my propositions. But I make light of the possible consequences to myself, in view of what I deem the justice of my cause. In the interest of that truth which is said to be mighty and always to prevail, of which, however, I have my serious doubts, I speak frankly in

what I deem the interest of Philadelphia, which I love; of literature, which I also love, and of art generally, which has been my never-ceasing pleasure throughout life. Mr. Moulton's merits are enthusiasm and elocutionary ability, his faults extravagance and defective logical perception. The result is seen in unbridled imagination soaring over the fields of literature, where, however entertaining, he is not a safe guide to dwellers on the average plane of life in mind, thought, training, and all that goes to form the individual as he stands. I proceed, after this necessary preamble, to the discussion of a few statements made by him on the occasion to which I have referred, not relating at all to the point that I have mentioned, but involving what many others as well as myself deem the greatest heresy against tenets fundamental in literature, safely leaving to the sober second-thought and calm review of the literarily educated among his audience the justification of the opinion that I have expressed as to the general tenor and defect of his instruction.

Mr. Moulton opened his lecture with the strange remark that, whereas his own regard is especially reserved for literature in itself, doubtless that of the great majority of his hearers was concentrated upon the author. This was wholly irreconcilable with the fact of the presence of the large audience that greeted him upon that occasion for the ostensible purpose for which it had assembled. Interest in authors, among any portion of the reading public, is always subordinate to interest in literature. That public stands in exactly the same category, if not in exactly the same relation, to literature and authors, as does Mr. Moulton himself. He himself could not, if he would, divest himself of interest in individual authors compatibly with being interested in their works, the one interest with everybody being exactly proportional to the other. He protested too much in his intended exaltation of literature, more than it is human to feel, for there is, upon the assumption of individual love for literature, no other category than one inclusive of the highest teacher and the lowliest scholar, in all that regards the relativeness of literature and the author. If Mr. Moulton's statement were correct, as representing a possible condition of mind, it would be futile to address any mixed audience assembled for literary entertainment and instruction, except by first endeavoring to convert its component individuals from the error of their way of

thinking, that the author is more interesting than his book. But that was evidently not the intention of the lecturer, as set forth in his printed Syllabus of the lecture course, but to make critical study of specimens of the higher literature, upon the assumption of general knowledge of, love for, or at least capacity to learn to appreciate, the productions of master minds in the various provinces of literary art.

A statement in Mr. Moulton's lecture, much more worthy of notice, however, because it involved a dangerous thing to say before a mixed audience, without due qualification to forestall any possible misunderstanding as to the limited reach of the declaration, was contained in his repudiation of all authority for the laws of grammar, clinching the assertion by the remark that in England they do not "set so much store as we in America by Lindley Murray." He declared unreservedly, and proceeded to argue, that so-called laws of grammar are not binding, so repeatedly enforcing the point by using the expression of one of his correspondents, whom he cited as charging that Browning's Caliban "speaks bad grammar," as to impress the listener with the belief that he himself regards that expression as good English. That the sentiment was quite agreeable to some scattered groups among the audience was very evident from the gentle murmur of assent and the incipient stir of applause that arose among them. He went on to say that the popular impression that grammatical law is binding arises from confounding two different senses in which the word is used as defining two diverse things. Now, the idea of law, as everywhere apprehended, however imperfectly formulated as a statement of fact or obligation, however even provisional, has, as a term, but one signification. Relating to physical phenomena, it contains the affirmation of correspondence between cause and effect, authoritative with man. Relating to man, whether as supernally or humanly ruled, it contains the assertion of authority as defining conditions and imposing upon him obedience. Whether, then, the idea is expressed with reference to nature beyond or within man's control, the term corresponds with it, and always relates to that which he regards as authoritative.

Most unfortunate for Mr. Moulton's plea was the distinction which he attempted to draw between legislative laws and the law of custom in language. The essential difference between them,

he affirmed, lies in the fact that legislative laws are imposed by authority under penalty, whereas the so-called laws of grammar, being derived from language, and not it from them, are not of any binding authority whatever. But, just as a general consensus of opinion in a community is by legislative action reflected in the concrete form of legal enactment, so a similar consensus of opinion in a community as to language is reflected concretely in the forms in accepted general usage in speech. Back of all laws of language, as well as of all legislative laws, are mandate and penalty, none the less in the first because they are not there formally expressed. Human laws, whether legislative or otherwise, are, in a word, the expression of the will of the community. The laws of speech, as existing in a particular community, are therefore in their sphere as mandatory as are those of a legislature; nor is their infraction possible without incurring and suffering penalty. Attached to their infraction is the penalty resulting from less comprehensibility in written and oral speech, less ability to secure the widest audience, less possibility of communion with one's fellow-men, and at the lower depths, the absolute impossibility of maintaining the best social status. Because all peoples themselves make language, they cannot be bound by that which they create, is an untenable proposition, seeing that in the evolution of human affairs practice comes first, and then custom, and then the formulation of custom in the unwritten law of precedent, if not in the shape of written law. It is the individual that is bound by the law of grammar as well as other law, not the community creative of correspondent language, and failure to discriminate between the essentially different agencies as, on the one hand, representing authority, and on the other obedience, leads from specious view to specious statement. It may be frankly admitted that Caliban has a right to a grammar of his own, without at the same time admitting that there is no law of grammar, when it is considered that we find all men, up to their individual capacity, using speech with recognition of law incorporate in every individual tongue.

Another unfortunate statement made by Mr. Moulton in the lecture referred to, was when he answered certain criticisms upon Browning, that no matter how he varies his theme, he is generally obscure and ever identifiable through his mask. Mr. Moulton asserted as to these strictures, that every great author

necessarily has his medium through which he must address his world, and it is for his world, if it incline to love him, to study to become familiar with the medium in which the message of the seer is at first enshrouded. But even undeniable greatness in literature, and such is Browning's, does not depend upon obscurity, but must needs be lessened, not increased by obscurity. Neither does personality, inseparable from utterance, enhance, but, on the contrary, it limits literary greatness. Unless we are to renounce existing standards, obscurity cannot be admitted as a merit, but must be recognized as a defect. Mr. Moulton mentioned *The Ring and the Book* as perhaps the greatest of all poems, and therefore, inferentially, Browning as perhaps the greatest of all poets. The work is marvelously fine, despite fitful, but by no means continuous obscurity, despite portions in which its style is too Hudibrastic to suit the graveness of the theme, and most notably of all (because it might so easily have been otherwise by a halt in time), despite the lameness of its ending. Browning himself says, in the very first line of the superfluous last part of the poem, "Here were the end, had anything an end;" yet relentlessly goes on to reflections of the late actors on the scene, now tame and uninteresting, with even mention that Guido died penitent (with short shrift it must have been, an hour or so at most, including the procession to the place of execution); for which the reader cares not a jot, such terrorized reconciliation of life with death being the common end of darkest criminality in face of unexpected retribution. Fearful is the anticlimax, with its additional Byronic looking towards and mention of the "British Public," when, merely by omission, the grandest possible climax lay just before the author, where the doomed miscreant, Guido, renouncing on the instant his mock heroics and blatant atheism, as he hears his executioners at his cell's door, every shred of pretense falling from his naked hideousness, cries, "Abate,—Cardinal,—Christ,—Maria,—God, . . . . Pompilia, will you let them murder me?" The tale is told. There is a natural ending, beyond which extension is but injury: even the epilogue is out of date. But such things apart, can it possibly be thought as worthy of existence as the first part of Faust, which, if men remain as men now are, must endure until earth, grown cold and lifeless, still rolls on through space. To address his world, a limited world, a less

than the greatest type of author may be obscure and must be personal through his writings, but to address the whole world, to be greatest in literary art, one must so dominate it in clearness and impersonality as though behind the Olympian clouds, where almost alone stands Shakespeare. The grand epic traits of Homer, all but his equal among the immortals, admit of no direct comparison between them, but speaking broadly, there is nothing to choose between them on the score of clearness and impersonality.

It is recognized that what is superlatively great in art is known as such by all orders of men: the fact is thus determined. Before such works no veil of obscurity hangs, but supreme greatness in them is revealed, if not equally, at least as a presence to all men. This law of perception, however, does not exist for science and the highest scientific men. Herbert Spencer has toiled through a long life generally unknown, and wholly unremunerated with this world's goods, although, with well-poised brain and feet firmly set on logical procedure, he has made a march of progress, barring his agnosticism, joined by thousands who have taken fire from his torch to millions beyond unaware of whence came the light. But art is for all the world, by the simple avenues of sense, with much or little intellect, while science, the possession of the few, must ever remain beyond the ken of the multitude save in diluted forms of knowledge. Yet, in entire forgetfulness of the present civilized standpoint in science, Mr. Moulton declared that the savage's knowledge of nature far exceeds that of the civilized man. The ground taken for the assertion was the savage's recognized capacity in woodcraft, following trails, and other skillfulness of the most primitive sort, forced upon him by his daily needs, and not to be spoken of in the same breath with the larger acquaintance with nature possessed by civilized man for centuries, especially that represented by the late wondrous civilized advance through study of the highest physical laws.

The *omne admirari* is as pernicious a phase of the human intelligence as is that of the *nil admirari* attitude of mind. To be catholic in taste is not to embrace all creeds and proselytize to every faith. To enjoy truly, with exalted sense, is to discriminate. To have the highest æsthetic enjoyment throughout life depends upon holding one's self in the attitude of receptivity for

all that may appeal to one within the present accepted canons of good taste, and beyond, even if it be unfamiliar, for genius is ever enlarging the bounds of taste. The canons of good taste at a given moment of time represent but the evolutionary point of general human advance, beyond which one cannot proceed sanely by leaps, but led by genius, may enter untrodden space beyond. Except the fundamental, there are no absolutely fixed canons of good taste in art but the academical, and they are constantly invaded, for the grand jury of the world is always in session to decide upon works of art, and its decision is final. The life of the individual artist may pass away unrecognized and unrequited, but the span that the longest life compasses is short in comparison with that which may be for all time. To attempt to defend the greatest author at every point, to find no blemish even in obscurity, to make human imperfection flawless, is mistaken zeal. One of the most conspicuous marks of genius is the inequality of its productions. Look for confirmation anywhere, amid many cases that might be cited, to Goethe, to Victor Hugo. In a single work, *Wilhelm Meister*, are to be met palaces and huts, jostling each other. What a great gulf divides *L'Homme qui Rit* from *Nôtre Dame de Paris*. Compare George Eliot's *Romola*, gem of the purest water, with *Daniel Deronda*, and thence descend in our survey to the depths of ineffable dullness in *The Impressions of Theophrastus Such*. Truly, there is difference in kind between these, making intimate comparison between them impossible; but it is purely between degree as limited by kind as kind that I am instituting the comparison. Is each production of these authors as good of its kind as is another by the same author of a different kind, within its kind; and is not one wholly unworthy of another? that is a fair consideration. Within the very same kind, however (let us put the question to a crucial test), shall we, out of love for Shakespeare, say that even he is always equal to himself? Instance any men and women of genius, and it can easily be shown, if they produced much, that side by side with great performance lies what was beneath their greatness to produce, if it go no further (but it does go much further) than such lapse where even Homer nods. Vainly, because we love an author, would we claim for him equality in all his creation. If so attempting, we really seek to strip him of one of the characteristics that shed, not lustre, but a side-light, on the title to his fame.

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Mankind is subject to epidemic crazes of anticipation, admiration and repudiation. The Mississippi Scheme and the South-Sea Bubble, blown to hugest dimensions by the breath of millions, sailed upward until burst by continued puffs of praise. Within a very short period Brown-Séquard, who did not even claim that which the public attributed to him, was raised heavenward, then dropped to earth. Koch was most wisely moderate in statement; all to no purpose when the imagination of the public set sense aflame. Even tulips, two centuries ago, and orchids, but yesterday, have each had with the proverbial dog their little exalted day; that of the dog, as no longer individual, but collective in popular admiration, reigning at present throughout the whole Anglo-Saxon world. In what an unæsthetic general atmosphere of judgment of excellence we live we must perceive upon reflection that, through jaqueminots, la France, and other types, it took fashion at last to find out, and that but lately, the beauty of the rose. But this especially modern development of factitious rapture is not in the real interest of anything good, least of all in that of cultivating popular taste for art. The best interests of that cultivation lie in appreciative recognition of greatness, though careful discrimination and frankest acknowledgment of imperfections as well as merits in a work of art, while at bottom thankfulness is felt for the gift that has been added to the sum of blessings. It is not ennobling to kiss with equal fervor the clay feet and the golden brow of our idol. Gladly let us welcome him among our household gods; remembering, however, that after all, he is human, but all the more lovable for being so. Let us avoid lauding his imperfections, as did Mr. Moulton, when he claimed merit even for the obscurity of Browning, because, as he said, it arises "from excessive sight." The defense is inadmissible; for art depends upon perspective, upon rigid selection, involving therefore exclusion, converging upon finest limitation, resulting in ideal form evolved from void. He who in literature strives at any time to include, or does inadvertently include, in the treatment of a theme, more in quantity or in quality than its development can symmetrically combine, has not then successfully raised the sleeping angel from the block of marble. Virgil, with excessive requirement of his own exquisite skill, well understood the demands of the highest art, when he willed that at his death the work which he had not yet published should perish; for he

as well as others of the ancients knew well, as the French of modern times know and strive to practice, that it is in perfection of form that literary as well as all other art chiefly and almost wholly resides; and in literature, unlike other art, which is limited, form includes color, and even the "concord of sweet sounds," and all else that, from delicacy to robustness, through human strength and weakness, appeals to the wide range of affections in the responsive heart of man.

Whoso likes, in poetry or prose, unformed, elusive idea, that sparkles evanescently with promise but half-redeemed in uncoördinated thought, either enjoys the contemplation of his own profundity, not the author's work, or else is himself so much poet or reasoner that, from fitful gleams of light, as one may think out a whole heaven, inspired by the droning from a stupid pulpit, he shapes to suit his fantasy what, not the bard nor other writer, but his unconscious self lends to the satisfaction of his soul. In either case is self-analysis wanting, which would prove to such misguided beings that works which so inspire are not of art, but of art's inchoate suggestion; a pleasant sketch perchance, but not the finished picture, in which they themselves complete the task; for although in literature the delicately, not the mathematically expressed idea, combines the finest finish with its form, it is also true that in it all should ever tend from airy nothing, not thither to revert, or never issue. Admirably Browning says:

> "Fancy with fact is just one fact the more;
> To wit, that fancy has informed, transpierced,
> Thridded and so thrown fast the facts else free,
> As right through ring and ring runs the djerid
> And binds the loose, one bar without a break."

But, just as in all literary art the djerid, *fancy*, is needed truly to bind fact together in all-inclusive bond, so also in all literary art is needed the first of facts, the djerid, *form*, to "bind the loose," in parts and whole, as one "without a break."

## *A Sketch of the Life of Dr. Gouverneur Emerson.*

*By W. S. W. Ruschenberger, M.D.*

(*Read before the American Philosophical Society, May 15, 1891.*)

Descriptions of the peculiar attainments of members of the American Philosophical Society, and of their labors to increase and diffuse knowledge of truth of any kind, are interesting features in the Society's annals. For such reason it has long been a practice to have prepared a suitable notice or memoir of every resident member soon after his death.

At the close of his life Dr. Emerson had been a member of the Society more than forty-one years. He was warmly interested in its welfare, and took a more or less active part in its proceedings. Notwithstanding his worthiness of it, a tribute to his memory in the Society has not been recorded.

Just after his death, in 1874, it was suggested that I should prepare a notice of him. Inquiry at the time led to the belief that materials for a suitable memoir could not be easily obtained. Even among his intimate friends, Dr. Emerson was notably reticent about himself, never indulged in reminiscences of his past experience: in fact, his associates knew nothing of his life or career.

Recently, however, his near kinsmen have kindly opened sources of information, and now, after long delay, a sketch of his life and work, in sufficient detail for estimation of his character and measurement of his usefulness while living, is respectfully submitted.

Emerson is an ancient English surname and probably not hereditary.

The Emersons of Delaware sprang from a respectable English parentage, and were among the early colonists of Penn's province. They were all farmers, and proprietors of their farms.

The grandfather of the subject of the following sketch, Gouverneur—familiarly called Govey—Emerson, his wife Sarah, born Manlove, and their six children, were received into membership of the Duck Creek Meeting of the Society of Friends in 1757.* His youngest son, Jonathan, born July 17, 1764, married Ann Bell in 1794.† They had seven children,

* Records of Duck Creek Meeting, Kent county, Del.

† *Genealogical Note.*—Gouverneur Emerson married Sarah Manlove, 1746.
Issue—Jacob, b. 1751; m. Sarah Stout.
Manlove, b. 1759; m. Susan Blundell.
Jonathan, b. 1764; m. Ann Bell.

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Robert Bell m. Mary O'Brien of Ireland.
Issue—Henry, Robert, Thomas, John, Mary, Agnes, Lucy.
Henry, m. Elizabeth Lewis.
John, m. Mary Lewis; issue—Ann, Margaret, Mary, Lucy, Eliza L., Stephen.
Ann (Bell) m. Jonathan Emerson. Issue—Gouverneur, Sarah (died), Mary, Susan B., Manlove (died) and Ann Eliza.

George Emerson

two sons and five daughters, the youngest of whom is the sole survivor. The eldest of them, Gouverneur Emerson, was born August 4, 1795, near Dover, Kent county, Del. In after-life he remembered with pleasure that when little more than seven years old he was permitted to roam in the woods with a gun.

At an early age he was sent to the Westtown School, a famous boarding school under the direction of the Society of Friends, which was opened May, 1799, in Westtown township, Chester county, Pa. He returned to Dover in 1810, and was for a short time at a boarding school in Smyrna. Thence he was transferred to a classical school at Dover, the principal of which was the Rev. Stephen Sykes.

With the preliminary education acquired at those schools, and prompted by his mother, he began to study medicine at the age of sixteen, 1811, under the preceptorship of Dr. James Sykes, a prominent surgeon and eminent citizen, who was a first cousin of his mother. Dr. Sykes was once Governor of the State of Delaware, and during many years presided in its Senate.*

His father, Jonathan Emerson, died in 1812, leaving his family an ample real estate, consisting of farms and improvements thereon.

Gouverneur continued his study and went to Philadelphia, probably in the autumn of 1813, to attend medical lectures.

His mother, in 1814, married Manlove Hayes, who had children by two previous wives. He was born in 1769 and died in 1849, aged eighty years. The children of his third marriage were Harriet Sykes, Manlove and Charles P., all of whom are living. Their mother, a lady endowed with excellent womanly qualities and a strong character, so managed her family that her children and those of her husband were never aware of any difference or preference of kinship, and were affectionate friends during their lives.

Having attended three complete courses of lectures and submitted an inaugural thesis on *Hereditary Diseases*, the University of Pennsylvania granted Gouverneur Emerson, March, 1816, the degree of Doctor of Medicine. He was a member of the Philadelphia Medical Society from 1813, and was elected its Secretary in 1816.

Prior to his graduation he was a private pupil of Dr. Thomas Chalkley James, an eminent practitioner, who was professor of midwifery, the first

Ann m. (second time) Manlove Hayes, Esq., of York seat, near Dover, Del. His great-grandfather, Richard Hayes, the first *American* ancestor of the family, settled in Delaware in 1698, at the age of 20, and m. Dolly Manlove.

Issue—Harriet Sykes, Manlove, Charles P.

Mary m. 1st Jones, 2d Francis, 3d Edgar.

Agnes m. James Sykes (a delegate to the First American Congress).

Issue—James, Nancy (who m. Commodore Jacob Jones, U. S. Navy), Matilda, John, Harriet.

Lucy m. Rev. William Magaw, D.D., Rector of St. Paul's P. E. Church, Philadelphia. Buried under the church.

* Biographical Memoir of Dr. James Sykes. By Gouverneur Emerson, M.D. Journal of the Medical and Physical Sciences, February, 1823.

ever appointed, in the University. During this association a warm and enduring regard sprang up between them.

Dr. Robert Hutchinson Rose had purchased, in 1809, a hundred thousand acres of wild land,* which included the township of Silver Lake, near Montrose, the capital of Susquehanna county, Pa., and was endeavoring to attract settlers upon it. He and Prof. James were cordial friends. Possibly influenced by the Professor's good opinion of his young friend, Dr. Rose invited Dr. Emerson to be his family physician, to become a member of his household, and practise medicine in the neighborhood. Prof. James advised him to accept the offer, suggesting in support of his advice, that a settled occupation in the country would fortify his health, which at that time was slightly impaired.

Dr. Emerson arrived at Silver Lake about the end of September or beginning of October, 1816. He was a tall, slender man just past the twenty-first anniversary of his birth, and was, no doubt, hopefully forecasting the future of his career. Before he received Dr. Rose's invitation he had designed an excursion to the Northern States. After a survey of the position he was to occupy, he determined to delay beginning his work until after he had made his projected journey.

In a letter of seven closely-written foolscap pages, dated Silver Lake, Dec. 5, 1816, and addressed to his friend at home, Alexander L. Hayes,† he gives a full summary of his observations during his excursion.

He started alone on horseback from Silver Lake, October 15, 1816, and at the close of the next day reached Unadilla, a New York village, not very many miles beyond the northern boundary of Pennsylvania. There he was not a little surprised to learn that a Philadelphia banknote for $100, with which he had supplied himself to pay his traveling expenses, would be received only at a discount. He was obliged to give that note for ninety dollars in notes of New York banks. Travelers of the present time are not taxed in such manner, because our paper money has the same value everywhere in the United States.

He visited Schoharie, Schenectady, the Balstown Spa, Saratoga, and, passing over the Hudson river at Fish Neck, entered Vermont. From Rutland he crossed the Green Mountains to Montpellier and Danville; passed several days in Southern Canada, traversed New Hampshire and the province of Maine, and returned by the way of Waterford, Troy and Albany, to Silver Lake, after a ride of about 2000 miles.

Having been born and bred in the country, he naturally devotes a large part of his letter to descriptions of the soil and the agricultural value of lands which he saw on his way.

* Precisely, 99,200 acres. History of Susquehanna County, Pa. By Emily C. Blackman. Claxton, Remsen & Haffelfinger, Philadelphia, 1873.

† Alexander L. Hayes, son of Manlove Hayes by his first wife, was born in Sussex county, Del., March 7, 1793, and was President Judge of the Court of Common Pleas in Lancaster, Pa., from 1833 to 1849, when he resigned, and was again elected 1864 and died in office, 1873.

See, Biographical Encyclopedia of Pennsylvania. Philada., 1874.

In reference to the people he says: "The Yankees have a great deal of frankness about them. If they are very desirous of knowing your circumstances, and of course, inquisitive, they are willing to tell you their own. Knowledge, religion, civility and money are more equally diffused in New England than in the Middle and Southern States; but there are not as many men of brilliant talents or true piety—more common civility but less polish, and few opulent men, and girls of course. * * * They have a fondness for title and distinction. The most respectable men by far are the tavern-keepers. * * * You will hear that Judge ——— keeps there, and that General ——— five miles this side, and that they are *nice* men; a *nice* man and a fine Yankee are equivalent terms. * * * They call all kinds of vegetables sauce."

Dr. Emerson, who was probably the first physician settled there, practised his profession at Silver Lake nearly two years.

At the instance of a friend, Mr. Andrew Hodge, he was appointed, November, 1818, surgeon of a merchant ship, called the *Superior*, Captain John Hamilton, bound to China.

He joined the vessel, which had already dropped down the river, December 7, 1818. The weather was stormy and the wind adverse. The *Superior* did not get to sea till the 12th.

The cabin mess, composed of the officers of the ship and three passengers, counted eleven persons, a number quite sufficient to shield them from a sense of weariness or solitude.

Dr. Emerson kept a journal. A brief notice of the nature of sea-sickness is recorded the first day at sea.

On the 13th, out of sight of land, a brig from Prince's Island, coast of Africa, bound to Rhode Island, was spoken. She had been seventy days at sea and was short of water. As the quarantine laws were then very rigidly observed at Marseilles, the port to which the *Superior* was bound, to avoid risk of vitiating her clean bill of health which might be consequent upon direct personal communication with any vessel or place before reaching Marseilles, casks of water were thrown overboard and picked up by the brig.

On the 14th, being then in the Gulf stream, the Doctor notes in his journal the use of the thermometer in navigation.

January 26, 1819, the *Superior* arrived at Marseilles, thirty-five days from the Capes of the Delaware.

As soon as the ship entered the mole, the captain went to the Health Office, but was required to remain in his boat outside of the grate, and to throw his papers into a tub of vinegar presented to him, the object being to destroy any contagious matter they might contain. Letters brought for persons on shore, after being cut through in several places to give easy access to the vinegar, were treated in the same manner. Every vessel arriving was required to undergo quarantine. No person was permitted to land, and none to visit her from the shore. A guard was stationed on board to enforce observance of the rules. At the time the plague prevailed in the Barbary States.

A celebrated Dutch physician, Boerhaave, recommended distilled vinegar as an efficient remedy against putrid diseases. Vinegar was supposed to be antiseptic and therefore protective against all contagions. The hands of those who had to do with contagion were moistened with it, and their clothing and other objects were exposed to its vapors. During the plague of 1720, at Marseilles, it is said t at four convicted thieves, who were employed in caring for the sick, protected themselves from the contagion by the use of vinegar, and were granted their lives on condition that they would reveal the means they used to shield themselves in their perilous work. And hence, perhaps, came the preparation called "Thieves' vinegar."

But since modern studies of the processes of fermentation and putrefaction have led to the belief that they, as well as all contagions, are due to the presence of microscopic organisms, vegetal or animal, called mycroderms, bacilli, microbes, etc., vinegar has lost its antiseptic reputation.

Early on the morning of February 4, the Harbormaster came alongside of the *Superior*. Learning from the guard that no one on the ship was sick, he came on board; and, after disinfecting the officers and passengers in the cabin and the sailors in the forecastle, by exposing them to the pungent fumes of oxymuriatic acid gas (chlorine), he granted *pratique*, *i.e.*, liberty of the port. Then the ship was moved to the vicinity of the Custom House, and the gentlemen found quarters at the Hotel des Ambassadeurs.

After a sojourn of two months at Marseilles the *Superior* sailed April 5, and on the 15th anchored in Gibraltar bay; and was detained some time in quarantine, and afterwards many days waiting for a favorable wind. Before daybreak, May 6, 1819, the anchor was weighed and on the 7th the ship was fairly at sea.

August 1, the ship was anchored at Angier, Java, and on the 3d proceeded on her way. The anchor was let go again, Aug. 20, off Macao, where merchant ships bound to Canton were detained twenty-four hours. In the afternoon of the 21st a passport to proceed up the river was granted and a pilot sent on board. The ship started about half-past three o'clock P.M., and anchored in the Bocca Tigris sometime after midnight. The pilot landed the next morning to exhibit at the fort there the "chop" or permit to go up the river, and brought back two pilots and two Mandarins to remain on board till the ship reached Whampoa, the common anchorage of foreign ships trading at Canton. It is sixteen miles below the city. The *Superior* anchored in the evening of the 23d, and on the 26th, Dr. Emerson and fellow-voyagers were lodged in Swedes Factory at Canton.

In a letter to his mother, dated November 5, 1819, Dr. Emerson says: "After the first impressions of the abundant novelties wore off, the dull uniformity which followed became tedious, and time now appears to fly slowly."

He relates that in consequence of drinking Samshoo, a liquor prepared from rice, which in excess produces a fierce, maniacal intoxication, the crew of the *Superior* mutinied, and, in the absence of the captain, endeavored to kill the officers and take possession of the ship. Officers of other vessels lying near, immediately joined in the conflict. Some of the crew were knocked down and others stabbed. Eight of the ringleaders were put in irons, and fed on bread and water for ten days; and under such treatment became as subordinate as they always had been.

He gives account of an accident to himself which might have been serious, as follows:

"I went on board a ship where they kept a Spanish bloodhound. He was tied before I went on deck; but while sitting in conversation with some of my friends, he broke loose and sneaking alongside leaped into my face. The damage I sustained was a wound through the left lower eyelid, a deep cut on the temple, and one under my shoulder, together with a very black and inflamed eye, from all of which, I am happy to inform you, I have recovered. The dog is the most savage of his species. I escaped *very well considering*. He has injured others more seriously."

Referring to mosquitoes, he says: "I sleep under a net which lets the air circulate, but keeps out every kind of insect. You will be pleased to see it. I think the plan so ingenious and good that it will be adopted by many of our friends."

A plain implication from the Doctor's remark is that the mosquito net was a novelty to him in 1819, and not known in the neighborhood of his native place. Are we indebted to the Chinese for this invention?

The party finally left Canton for Whampoa, Nov. 22. The ship had been moved below the common anchorage when they reached her about noon. She arrived at Lintin on the 23d, and there found the U. S. frigate *Congress*, Capt. John D. Henley, said to have been the first American man-of-war to visit China. She anchored here Nov. 3, with many of the crew suffering from dysentery, ascribed to the water taken on board at Angier. Her presence aroused the suspicion of the Chinese authorities that it meant no good, and therefore they would not allow provisions to be furnished to her from Canton. The *Superior* brought several barrels of bread for her use, and other American merchantmen conveyed to her barrels of beef and pork.

On the 26th Nov. the *Superior* sailed from Lintin homeward bound.

On Saturday, Jan. 16, 1820, then in the Indian ocean, she was boarded from a Patriot privateer, said to be two months out from Buenos Ayres. She was armed with sixteen guns and had a crew of two hundred men.

Dr. Emerson, in his journal, says: "We first discovered her on Friday morning, about three miles off our starboard quarter, standing on the same course. The wind was light and unfavorable; a high head-swell further impeded our progress. Towards night the strange sail had gained upon us. We thought she showed a desire to speak. Every precaution seemed to have been taken to disguise her real character, by carrying

little sail, but we still suspected her of foul intentions. The night was dark, but she kept close to us and always in sight. In the morning, being off our weather quarter, within gunshot, she ran up a Spanish flag and fired a gun to bring us to. When close to us she backed her topsails, hauled down the Spanish and ran up the Patriot colors, at the same time opened all her weather ports, ran out her guns and brought her whole broadside of eight guns to bear upon us. The star-spangled banner floated over our quarterdeck.

"We now thought ourselves in a rather unpleasant situation. Although no declared enemy, still the many outrages and piracies under what was called the Patriot flag made us fear we might not fare better than others under similar circumstances.

"Her boat, rowed by a set of cutthroat-looking fellows, came alongside. The officer, apparently of inferior rank, wore a belt full of pistols and daggers. He was without a coat and barefooted. A renegade American attended him as interpreter. Having noted the ship's name, the latitude and longitude, etc., this accomplished officer directed his attention to our breakfast table, at which we had just intended to sit down. After refreshing himself and companions, the work of plunder began. They robbed us of many barrels of beef, pork, bread, butter, tea, silk, canvas, iron kettles, live stock, etc. The villains seemed to think themselves as fairly entitled to what they took as if they were purchasers. Whenever they came across anything they fancied, they said with all effrontery imaginable, 'Half for us and half for you,' adding from time to time, by way of consolation, 'We don't want to do you any harm.'

"They stated that they had a great deal of sickness on their ship and were throwing men overboard every day. They tried to induce me to join them, offering any rate of wages I might ask. They had a surgeon, but he was so indifferent that if in my way they would throw him overboard, and so get rid of him. His pay was a hundred dollars a month, but they would allow me any price I asked. Having consulted among themselves aside, they said that they had agreed not to force me to go with them against my will, although they were so much in want of medical assistance. According to their account the prevailing diseases on board were scurvy, dysentery, fever and ague, which had reduced what remained of the crew to a deplorable condition. Receiving a decidedly negative answer from me to their invitation, they next demanded a supply of medicines. I gave them some of a common kind, such as I thought might be useful to the wretches. The suspicious rascally officer took some of each one on the point of a dagger and thrust it into my mouth, watching me intently all the while, not satisfied till he had seen it on my tongue. This experience reminded me of a ludicrous scene in the "Honeymoon," where the doctor is forced to take his own medicine or be thrown out of the window.

"Though they robbed us in this unwarrantable manner, we were not treated as badly as we had expected. A strong breeze sprang up which

prevented their small boats from passing between the two vessels. They permitted us to make sail, but followed in our wake. The breeze stiffened to a gale. Night came, dark and stormy. We changed our course. On the following morning, to our great joy, nothing was seen of our piratical friend."

March 20, the *Superior* was boarded by a Delaware pilot, and in the evening of the 23d reached Chester, 117 days from Lintin. The ship had been absent from Philadelphia sixteen months.

His journal during the voyage contains testimony of industrious study and intelligent observation of all things at sea or on shore that impressed their images on his mind. Marine animals and aquatic birds, wherever they appeared were described. Drawings of some were made. These and original sketches of places seen, and maps of ports visited, with now and then an apt quotation from some poet, illustrate his pages.

He gives detailed accounts of what he saw at Marseilles and on his way to it. Whatever was new to the young traveler seemed to be charming. Appearances of people and things, famous localities with their historical associations combine to quicken curiosity and impart a glow of interest to his record of pageants viewed, of visits to hospitals, public buildings, theatres, museums, etc. Days were passed at Aix, St. Remy, Nimes, Avignon and Vaucluse. Many pages are given to descriptions of the remains of ancient Roman buildings, and of whatever interested him in those places.

He gives interesting accounts of Gibraltar, and describes a visit with a companion on horseback to Algeçiras, a port of Andalusia, six miles west of the famous fortress.

At Angier, in the Straits of Sunda, he tells of the many canoes and boats which came to the ship with fowls, fruits in great variety, vegetables, Java doves and Java sparrows in little bamboo cages, monkeys, paroquets, sea shells, and animals of the deer kind not taller than our domestic cat, and all being at moderate prices found ready sale among strangers. The natural, corporal characteristics of the Malays, seen here, their costume, language, as well as the appearance of their dwellings on shore, the mountain scenery, tropic vegetation, and political condition are sketched and commented upon.

Macao, Whampao, Canton, Lintin ; pagodas, scenery and Chinese boat population along the river are in like manner noticed in detail.

The instruction derived from his observation and study, and the formative influence of his experiences during those months of separation from home, may not be definitely measured, but possibly to his alert mind they were as effective as the training of a college course.

With such preparation for work, on the 4th of August, 1820, the twenty-fifth anniversary of his birth, Dr. Emerson settled himself at No. 37 Chestnut street, Philadelphia, ready to give professional attention to any who might ask it. Possibly the time might have been opportune to introduce a young physician to business. Thirteen deaths from yellow

fever in the city had been reported during the season of 1819. The circumstance had created a vague apprehension of its recurrence, and may have induced people to appreciate practitioners of medicine more highly than when there was no prospect of needing them; and consequently, new candidates for practice might be more promptly noticed. The apprehension was realized to some extent; during the autumn of 1820, seventy-three persons died of the disease in the city.

Dr. Emerson was appointed an attending physician of the Philadelphia Dispensary, September 19, 1820, and resigned the office, May 21, 1822.

The City's Councils elected him a member of the Board of Health, March 12, 1823; and the Board appointed him its Secretary the same day. It is conjectured that he resigned three years later.

Prevention of the introduction and spread of smallpox in the city at that period attracted attention. Between January, 1818, and December, 1822, five years, only nine deaths from smallpox in the city had been reported. Fear that the disease might again enter the city was no longer manifest. For this reason it was supposed that vaccination had been generally neglected in the community.

The Board of Health was without authority to enforce measures to prevent the spread of the disease, then present, and for this reason its members were not willing to act; but at the instigation of Dr. Emerson the Board announced in the daily newspapers, three times, that smallpox was in the city and recommended all unprotected persons to be vaccinated without delay. The same year, November 15, 1823, the Board again warned the public of its danger, saying, "And as it is believed that there does exist among some an unjust prejudice against the practice of vaccination, the Board conceives it a duty to declare that the evidence afforded by our city in its long exemption from smallpox, together with the happy results which have followed the introduction of vaccination in all parts of the world, ought to be sufficient to convince the most incredulous of the salutary influence of this inestimable preventive."

Dr. Emerson submitted to the Board for approval and transmission to the Legislature a draft of a law and memorial on the subject. The proposed law in substance provided that vessels having smallpox on board should be quarantined on arrival in the same manner as those affected with other contagious diseases; that inoculation of smallpox should not be practised in any case without the sanction of the Board; and that authority already conferred on the Board of Health to deal with contagious diseases specified should be extended to smallpox.

After debating the subject at several meetings, the Board approved the memorial and draft of the proposed law, January 28, 1824, and transmitted them to the Legislature then in session. Although 160 deaths from smallpox had occurred in the city during 1823, a member of the House of Representatives retarded its action on the bill after it had passed the Senate by securing a seemingly innocent amendment to it, but which in fact provided that appointment to offices connected with the Board of Health

might be so made as to reward political and partisan services without regard to fitness of the candidate.

Mr. William Binder and Dr. Emerson were sent to Harrisburg to point out the effect of the amendment, and at the end of four days' work they secured its rejection and the enactment of the original bill. A copy of the act was duly delivered to the Board of Health, April 7, 1824.

His work as a member of the Board of Health, and his communications to the newspapers pointing out the risk of permitting those affected with smallpox to freely mingle with citizens, bear witness to Dr. Emerson's disinterested benevolence.

During 1824, deaths from smallpox in the city numbered 325. They were reduced to six in 1825, and to three in 1826. But these facts are not conclusive that the measures taken by the Board of Health during this period contributed to abate the prevalence of the disease, because, both prior and subsequent to this time, the rate of mortality from smallpox in the city, between 1807 and 1840, fluctuated in the same striking manner, as Dr. Emerson shows in his papers on *Medical and Vital Statistics*, published in "The American Journal of the Medical Sciences," November, 1827, November, 1831, and July, 1848.*

Dr. Emerson published in "The Journal of the Medical and Physical Sciences," February, 1823, a brief and interesting memoir of Dr. James Sykes, who was his first preceptor in medicine; and a charming biographical memoir of Dr. Samuel Powel Griffitts, in the "North American Medical and Surgical Journal," in 1827.

July 6, 1832, Dr. Emerson, accompanied by Dr. Isaac Hays, visited the first case of "spasmodic cholera" that occurred in the city, his original description of which is in his commonplace book.

The disease became epidemic. Deaths from it numbered 1021. Dr. Emerson had charge of the Hospital for Orphans. As a token of appreciation of his service during the epidemic, a silver pitcher was presented to him, upon which is inscribed:

To
Gouverneur Emerson, M. D.,
The City of Philadelphia,
Grateful for his disinterested and intrepid exertions,
In a period of public calamity.

——:o:——

Transeat in exemplum.

He lectured in the Franklin Institute of Pennsylvania in 1833, on meteorology, and in 1834, he delivered another course on heat, electricity and galvanism, in connection with the subject.

* Mr. Pliny E. Chase reported at a meeting of the American Philosophical Society, February 5, 1869, and subsequently published, his *Comparative Statement of Mortality in the Society of Friends and that of the General Population of the City of Philadelphia from 1800 to 1869*, which, he states, was compiled largely from Dr. Emerson's papers.

Dr. Emerson was chosen to be a member of the American Philosophical Society, April 19, 1833. At stated meetings he made many brief communications on many subjects, which are recorded in Vol. i to Vol. xvi of the published Proceedings.*

He was one of the Councilors of the Society during ten years, from 1837 till the end of 1846.

He delivered a lecture *On the Advantages Derived from Cultivating the Arts and Sciences*, before the Philadelphia Mercantile Library Association, in the hall of the Musical Fund Society, December 8, 1839.

Among other points of interest, he states that the first successful attempt to cross the Atlantic in a vessel propelled by steam was made in a steamship called the *Savannah*, commanded by Moses Rogers, a native of Connecticut, but long a resident of Philadelphia. He sailed from New York, March 28, 1819, and arrived at Savannah, Ga., April 6, whence, after some delay, he crossed the ocean and arrived at Liverpool, June 20, having used steam or sails, as the wind permitted. From Liverpool the *Savannah* went to Elsineur, Stockholm, Cronstadt, St. Petersburg and Copenhagen. She then returned to Savannah, Ga., and thence went to Washington, D. C. Thus the practicability of crossing the Atlantic in a vessel propelled by steam was first demonstrated by an American.

In this connection he relates how Thomas Godfrey, an obscure citizen of Philadelphia, from a casual observation of the reflection of light, perceived the principle upon which he constructed, in 1730, the mariner's quadrant, and how he was robbed of the credit of his invention, and claims that Godfrey is entitled to "the lasting gratitude of all concerned, either directly or indirectly, in nautical pursuits, by inventing the only instrument that can securely guide the ship when far from land," and they should not permit only "a fragment of the most perishable stone" "to mark but for a few years longer the grave of Godfrey."

This appeal induced members of the Mercantile Association and others to construct a suitable monument to Godfrey's memory.

*The subjects upon which he made oral or written communications are as follows:

The production of electricity from the animal body; the production of electricity from steam; observations on Mower's paper on meteorology; excessive mortality of male children; effects of hot weather on infants; causes operative in changing the proportions of the sexes at birth; importance of phosphoric acid in agriculture; phosphorescent light produced in the diamond by friction; the compound action of the mental and optical faculties concerned in vision; cultivation of cotton in the Northern States; cleaning flax-fibre for market; extent of propagation of atmospheric vibrations produced by explosions of powder; manufacture of the sugar and syrup of sorghum; imphæ, or African sugar cane and cultivation of sorghum; improvements in Whitney's cotton gin; Robbini's process for preserving wood from decay by injecting into it vapor of coal tar; remarks on the part taken by the American Philosophical Society in connection with the Franklin Institute, to establish stations for meteorological observations; earthquake of October 20, 1870, reported November 4, 1870, as to expanse over which shocks were noted; lunar influence on wet and dry weather; ascription of the gradual translation of the peach-tree belt southward on the Atlantic coast to the progressive removal of the forests, causing exposure of the fruit trees to severe climatic fluctuations.

The closing paragraph of this interesting lecture is here cited as a fair sample of its style and tone.

"I hope I have said enough to prove that for prosperity and security, nations are mainly dependent upon the intellectual capacities and acquirements of their citizens. We have never known or heard of one that has not experienced its days of trial, and it cannot be supposed that our own country, whose hills and valleys now rejoice in the possession of peace and abundance, can always be exempt from calamity. If ever driven by adverse fortune to fearful extremity, happy will it be for her, if, in that day, like France at the crisis referred to, or like England—sustained during her long and dreadful conflicts by the resources furnished through her Watt—be rescued by her philosophers! Let us, therefore, like France, and the mighty people from whom we chiefly spring, use all our efforts to foster and diffuse the arts and sciences, and to banish the word *impossibility* from our vocabulary."

Dr. Emerson delivered an address, June 1, 1843, at Laurel Hill Cemetery on the completion of an unostentatious monument erected to the memory of Thomas Godfrey.

The reason for this tribute is stated in the address, substantially as follows:

One day while an ingenious young man, Thomas Godfrey, a glazier, was replacing a pane in a window on the north side of Arch street, opposite to a pump, a girl after filling her pail placed it on the sidewalk. Turning towards it he saw that the image of the sun was reflected from the window into the bucket of water, and from it back to his eye.* This simple observation led him to study the law of the reflection of light, and to invent a quadrant with speculums to take the distances of stars which he supposed might be of service at sea. The same year, 1730, he had made his reflecting instrument.† One was taken to the West Indies and used during the voyage to ascertain the latitude. It was brought back to Philadelphia before the end of February, 1731. The practical value of the instrument was thus demonstrated.

Although James Logan, in May, 1732, described the mariner's quadrant constructed by Godfrey in a letter to the celebrated mathematician, Dr. Edmund Halley, then President of the Royal Society of London, he did not obtain credit for his invention. It is believed that Dr. Halley

* John F. Watson, in his "Annals of Philadelphia," states this incident somewhat differently. According to his account, which seems to be accurate, Godfrey was glazing at Stenton, the residence of James Logan, and noticed the reflection of the sun's image from the window to a piece of fallen glass and from it to his eye. He immediately went into Mr. Logan's library and took from the shelf a volume of Newton's works to consult. Mr. Logan entered almost at the same time, and asked him the object of his search, and was much pleased with Godfrey's ingenuity, and from that time became his zealous friend.

In those days glazing was done by soldering the panes into the frame work. Glaziers were also plumbers, and did not paint.

† He lent one to Joshua Fisher for trial in his surveys of the Delaware. See Watson's "Annals of Philadelphia."

suppressed Mr. Logan's letter, and communicated the description of Godfrey's quadrant to Hadley, a mathematical instrument maker in London, who, after making slight mechanical changes in the instrument, obtained a patent for it. In this way Godfrey's invention came to be unjustly called Hadley's quadrant.

Dr. Emerson establishes Godfrey's right to priority of invention on the testimony of James Logan, Benjamin Franklin, Peter Collinson and others.

Thomas Godfrey was born in Bristol township, near Germantown, on his father's farm of 150 acres, in 1704, and died in 1749, and was buried there.* He was fairly educated, and was a member of Franklin's famous Junto. He taught himself to read Latin.

Mr. John F. Watson, the annalist, convinced of the wrong done to Godfrey, sought his grave, ascertained the inscription which had become illegible on the gravestone, and in 1838, at his own expense, had the remains with those of his wife, father and mother transferred to Laurel Hill Cemetery.

The Mercantile Library Association and certain inhabitants of Germantown jointly contributed means to erect a monument to Godfrey, the completion of which was the occasion of Dr. Emerson's address.

Possession of several hundred patrimonial acres in Kent county, Del., accounts for his attention to agricultural affairs. He made numerous and extensive experiments to ascertain the comparative value of different fertilizers. He erected a building on Frankford creek, Philadelphia, in which was manufactured, under the direct management of a Frenchman named Jourdan, a fertilizer called Jourdan's phosphate. This product was extensively used during several years. In 1844 or '45, two tons of Peruvian guano were brought to Philadelphia as a sample. At his suggestion he and his friend, Mr. D. B. Cummins, purchased each a ton and introduced it to the farmers of Delaware. On one of his farms he constructed a mill for crushing bones by horse power. The work was imperfectly done; but by treating the crushed bones with sulphuric acid and mingling the product with ashes and fine earth a fertilizer was produced which proved to be a good substitute for Peruvian guano, and cost much less. By observation and experiment he ascertained, in 1849, that the delightful and peculiar flavor of our so-called grass butter is due to the sweet-scented vernal grass—*Anthoxanthum odoratum*—which flourishes in pasture fields till about the end of May, and upon which the cows feed. He obtained from this sweet vernal grass an essential oil, and ascertained that it contains *benzoic acid*, upon which its flavor depends; and that a small quantity of benzoic acid administered to a cow imparted to the butter made from her milk the same flavor it has while sweet vernal grass forms part of her feed.† He delivered appropriate addresses before horticultural and agri-

* Watson's "Annals of Philadelphia."

† See, Letter, Oct. 31, 1849, from Dr. Emerson to the Commissioner of Patents. Report of the Commissioner of Patents for the year 1849, Part ii—Agriculture—pp. 372-75.

cultural societies at several places in Delaware and Pennsylvania, and published a pamphlet on the cultivation of cotton in the Middle States. He edited *The Farmer's Encyclopedia and Dictionary of Rural Affairs*, an octavo volume of 1173 pages, illustrated by seventeen plates, which was published by Carey & Hart, in 1844. In adapting it to American use, Dr. Emerson added to the original English text about thirty per cent. of the volume.

Although attentive to whatever related to agricultural improvements, he was seriously interested in medical affairs.

In 1845 the New York State Medical Society invited the medical institutions of the country to appoint delegates to meet in the city of New York on the first Tuesday of May, 1846, and form a National Medical Convention to devise measures to promote the common interests of the medical profession and improve medical education. Many prominent physicians, representing medical bodies in different parts of the United States, were present. Dr. Emerson, one of the delegates from the Philadelphia Medical Society, was with them.

On organizing the meeting it was found that 133 delegates from medical societies in sixteen of the twenty-nine States were duly accredited, and that seventy-five of them were from New York. This partial and unequal representation led a delegate to propose that the Convention should at once adjourn *sine die*. His proposition was not accepted. After due deliberation officers were elected, and committees were appointed to prepare a plan of organization, etc., and among them a committee to prepare a code of medical ethics to govern the medical profession of the United States. Dr. Emerson was appointed a member of it.

The several committees were instructed to report at a meeting of the Convention to be held on the first Wednesday of May, 1847, in Philadelphia.

The National Medical Convention met at the appointed time, May 5. Of 239 delegates elected to it from twenty-two States, including the District of Columbia, 175 were present.

The committees appointed in New York presented their reports, which were duly considered.

The Convention, by a resolution adopted May 7, became the American Medical Association. The new organization elected officers, appointed standing committees and adjourned to meet in Baltimore on the first Tuesday of May, 1848.

Dr. Emerson participated in the creation of the American Medical Association. In a note written by him on the cover of a copy of it, he claims that the Code of Medical Ethics was compiled exclusively by Dr. Isaac Hays and himself. The Association still holds its annual meetings, always to the advantage of the medical profession, and is recognized as authority on questions of medical policy in the United States.

Dr. Emerson was a member of its first Committee on Publication, 1847, and served on till 1853; of the Committee on Medical Sciences, and con-

tributed to its report of 1850, Vol. iii, pp. 91–94, "Observations on Vital Statistics;" of the Committee on Hygiene, 1851; and of the Committee of Arrangements, 1855.

Dr. Emerson was elected a fellow of the College of Physicians of Philadelphia, February, 1847. He never contributed to its Transactions. He was elected a delegate from the College to the American Medical Association in 1849, and in 1858; and to the National Quarantine and Sanitary Convention in 1857, and 1858.

He was a member of the Academy of Natural Sciences of Philadelphia from August, 1853; of the Philadelphia County Medical Society from 1857, of which he was President; and of the Medical Society of the State of Pennsylvania.

Dr. Emerson's medical practice from about 1828 to 1840 was lucrative and extensive. His interest in agricultural affairs, always notable, gradually increased with the lapse of time, and his interest in medical affairs gradually abated till he relinquished the practice about the year 1857.

Dr. Emerson, by invitation, began to live with Mr. Henry Seybert, at No. 926 Walnut street, in May, 1856. Apartments in the house were assigned to each proportionately. Dr. Emerson was the caterer, though they did not mess at the same table, and kept a detailed account of the household expenses which were periodically and equally shared. They lived together in perfect harmony eighteen years—till Dr. Emerson died.

Mr. Henry Seybert and Dr. Emerson were warm friends. Their close association is notable because their pursuits and aims in life were wide apart. Their mental characteristics were quite different. They were alike in condition. Both were unmarried, and both in easy circumstances. In some respects their tastes and ways were the same, simple, economical.

Dr. Emerson had a working knowledge of botany, mineralogy, geology and physics. Mr. Seybert had been educated in Paris, and trained in the School of Mines to be a chemist and mineralogist, and after his return home did some good work. In these scientific paths they were congenial. But Mr. Seybert was deeply imbued with religious sentiment.

While he was in Paris mesmerism attracted public attention, and he became interested in spiritualism.

He had read that "it is easier for a camel to pass through the eye of a needle than for a rich man to enter the kingdom of heaven." His construction of this sentence made him unhappy. He was so much tormented by the thought that all his attempts to lead a good life were useless as regards *future* existence because *he was rich*, that he consulted pious men on the subject, and among them the Archbishop of Rouen. By them he was assured that the sentence was addressed to the *sinful* rich *only*, and not to those who gave of their goods liberally to the poor.* Whether his many charities were prompted more by disinterested consideration for others than by this assurance is conjectural. Be this as it may,

* Obituary Notice of Henry Seybert, by Moncure Robinson. Read before the American Philosophical Society, Oct. 5, 1883.

Mr. Seybert was known for his charity and public spirit,* but most distinguished by his deep interest in a supposition or doctrine that after death and disintegration of his body by natural decay or cremation, a man's soul, wearing the carnal appearance of himself, may, at any time, be made manifest to the living through the medium of specially endowed persons, and in this manner communication with the world of spirits may be held. In this modern spiritualism he was a staunch believer. Shortly before his death he gave to the University of Pennsylvania $60,000 to found a chair of philosophy, on condition that the University should appoint a commission to investigate "all systems of morals, religion or philosophy which assume to represent the truth, and particularly of modern spiritualism." †

While Mr. Seybert was engaged in the study of spiritualism, Dr. Emerson, who had no respect for his friend's belief, was occupied in endeavoring to improve agricultural methods and in cultivating his several farms in Delaware.

His mother, Mrs. Ann Hayes, died in 1862, aged 86 years. Her long life was exemplary in every sense, unselfish and continuously kind and charitable. The positions occupied by her children are significant of the mother's attention and care for their welfare. To her Dr. Emerson late in life ascribed his first love for the British classical writers.

Society in Philadelphia was discordant at the outbreak of the great Rebellion, because the interests and affiliations of many of its residents were in the South and with the rebels. Those persons were openly defiant, threatening and at times belligerent. To determine if possible who were and who were not to be trusted, a few loyal men held midnight conclaves

* Among acts which may be ascribed to his public spirit was Mr. Seybert's unsolicited gift to the city. He substituted a new for a good old clock and bell which had long well served to ring out the hours, joyful news as well as alarms, from the State House steeple to very far-off dwellers in the city. Unexpectedly the sound of the Seybert bell is comparatively very feeble, scarcely audible more than 500 feet in any direction during the busy hours of the day, or at any time when there is a moderate breeze.

In the following humerous stanza, its author makes use of this circumstance to contrast the "clash and jingle" of St. Mark's chime of bells which greatly disturbed the neighbors at the time:

"There's a bell whose swinging gives out no ringing,
And I hear no dinging in the State House yard;
And where its rolling looks like tolling
I stand and tremble lest my hearing's hard;
For, with steeple rocking and hammer knocking,
And people mocking,
I hear no more
The low dull mutter
Those dumb lips utter
Than the stone Washington before the door."

† Preliminary Report of the Commission appointed by the University of Pennsylvania to Investigate Modern Spiritualism, in accordance with the bequest of the late Henry Seybert (page 5). J. B. Lippincott Company, Phila., 1887.

Henry Seybert died March 3, 1883, aged 82 years.

which ultimately resulted in the organization of the Union League of Philadelphia, December 27, 1862, the members of which were pledged to "unqualified loyalty to the government of the United States and unwavering support of its efforts for the suppression of Rebellion." *

Dr. Emerson, who was elected a member February 16, 1863, daily visited the Union League and participated in its proceedings till the end of his life.

Dr. Emerson did not devote his time and thought exclusively to the practice of medicine and agriculture. He was interested in questions of political economy, social science. He translated the second edition of Le Play's "Organization of Labor," a learned and valuable contribution to the literature of the subject. This work, the last from his pen, was published in 1872.

He died very suddenly in his office, July 2, 1874, near the end of the 79th year of age. His grave is next to that of Thomas Godfrey, Laurel Hill Cemetery.

He bequeathed his ample estate, including several farms, which together contain more than a thousand acres of arable land in Delaware, to his kinsmen.

His long life was virtuously spent, and so far he was above the bulk of mankind. Seemingly always under the influence of his early Quaker training by his mother, never manifesting the least pretension to piety, or solicitude about his future existence, his daily conduct was shaped in obedience to the precepts of the Decalogue and of Christianity. Naturally modest and considerate of the rights of others, he was never aggressive. A dignified and courteous demeanor, varied attainments and the easy flow of his conversation made him a welcome and frequent guest in the society of good and cultivated people.

A genius for persistent labor never permitted his talents, which were far above the average, to be idle. His career was marked by habitual industry and useful work rather than by special achievement in any of his pursuits. Though not a discoverer, or a great leader in science, his exemplary conduct and benevolent labors entitle him to general approbation, and his memory to our kindly respect.

## Appendix.

A list of Dr. Gouverneur Emerson's publications :

"A Biographical Memoir of Dr. James Sykes, February, 1823." "Chapman's Journal of the Medical and Physical Sciences."

"Biographical Memoir of Dr. Samuel Powel Griffitts, 1827." "The North American Medical and Surgical Journal."

"Medical Statistics, being a Series of Tables showing the Mortality in

* Twenty-fifth Anniversary of the Organization of the Union League of Philadelphia, December 27, 1887. Press of J. B. Lippincott Company, Philadelphia, 1888.

Philadelphia and its Causes." "The American Journal of the Medical Sciences," November, 1827.

"Medical Statistics, consisting of Estimates relating to the Population of Philadelphia, with its Changes as Influenced by the Deaths and Births during Ten Years, viz., from 1821 to 1830 inclusive." "The American Journal of the Medical Sciences," November, 1831.

"Vital Statistics of Philadelphia for the Decennial Period from 1830 to 1840." "The American Journal of the Medical Sciences," July, 1848.

"Lecture on the Advantages Derived from Cultivating the Arts and Sciences." By G. Emerson, M.D. Delivered before the Philadelphia Mercantile Library Association, in the hall of the Musical Fund Society, December 8, 1839. Printed by A. Waldie, Philadelphia, 1840.

"An Address delivered at Laurel Hill Cemetery on the Completion of a Monument Erected to the Memory of Thomas Godfrey, June 1, 1843." By G. Emerson, M.D.

"The Farmer's Encyclopedia and Dictionary of Rural Affairs; embracing all the most recent discoveries in agricultural chemistry, adapted to the comprehension of unscientific readers, illustrated by numerous engravings of animals, implements and other subjects interesting to the agriculturist." By Cuthbert W. Johnson, Esq., F.R.S., Barrister-at Law; Editor of the "Farmer's Almanac;" corresponding member of the Agricultural Society of Edinburgh; the Horticultural Society of Maryland, etc. Adapted to the United States, by Gouverneur Emerson. 8vo, pp. 1173. Carey & Hart, Philadelphia, 1844.

"Address delivered before the Society for Promoting Agriculture of the County of Philadelphia, at their Annual Exhibition, at the Rising Sun Tavern, October 6, 1848." By Gouverneur Emerson, M.D. Henry C. Clark, Printer, Philadelphia, 1849.

"An Address delivered before the Delaware Horticultural Society at Wilmington, on the 24th of September, 1851." By Gouverneur Emerson, M.D.

"Report on the Agency of the Refrigeration Produced by Upward Radiation of Heat as an Exciting Cause of Disease." "Transactions of the American Medical Association," Vol. vi, 1853, pp. 139-152.

"An Address delivered before the Agricultural Society of Chester County, Pa., September 17, 1853." By Gouverneur Emerson, M.D.

"An Address delivered before the Agricultural Society of New Castle County, Del., at the Annual Exhibition held in Wilmington, September 12, 1855." By G. Emerson, M.D.

"An Address delivered before the Agricultural Society of Kent County, Del., October 15, 1857." By G. Emerson, M.D., of Philadelphia.

"Results of Extensive Experiments in the Use of Superphosphate of Lime, etc., communicated to the Agricultural Society of Kent County, Del." By Dr. G. Emerson, February 2, 1859.

"Jourdan's Ammoniated Superphosphate of Lime; its Nature and Uses;

with directions to farmers for applying it to their crops, and observations which cannot fail to impart much useful practical information."

[There is conclusive evidence that this pamphlet was written by Dr. Emerson.]

"Cotton in the Middle States; with Directions for its Easy Culture." By G. Emerson, M.D. Author of the "Farmer's and Planter's Encyclopedia," Philadelphia, 1862.

"Land Drainage." An address delivered before the Farmer's Club of Kent County, Del., at Dover, January, 1872. By G. Emerson, M.D., of Philadelphia. [Illustrated by a topographical sketch map of Kent county, Del.]

"The Organization of Labor, in accordance with Custom and the Law of the Decalogue; with a summary of comparative observations upon good and evil in the regime of labor, the causes of evil existing in the present time, and the means required to effect reform; with objections and answers, difficulties and solutions." By F. Le Play, Senator (of France), Inspector-General of Mines, Commissioner-General to the Universal Exposition (in Paris), of 1855, 1862 and 1867. Author of *Des Ouvriers Européens* and *La Reforme Sociale.*

"Les politiques veulent en un état bien règlé, plus des maitres des arts mechaniques, que de maitres des arts liberéaux." Richelieu (*Testament Polito*).

Translated by Gouverneur Emerson, M.D., member of the American Philosophical Society. From the French of the second revised and corrected edition published at Tours, in 1870. Claxton, Remsen & Haffelfinger, Philadelphia, 1872. 12mo, pp. 417.

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*Stated Meeting, January 2, 1891.*

Present, 17 members.

Mr. DUDLEY in the Chair.

Correspondence was submitted and accessions to the Library were announced.

A letter was received from Mr. L. Vossion, dated Philadelphia, December 20, 1890, accepting membership.

A circular was received in regard to the celebration of the seventieth birthday of Prof. Rudolph Virchow, from the Committee on the same in Berlin.

The report of the judges and clerks of the annual election was submitted, and the following members were declared the Officers and Council of the Society for the year 1891:

*President.*

Frederick Fraley.

*Vice-Presidents.*

E. Otis Kendall, Dr. Ruschenberger, J. P. Lesley.

*Secretaries.*

George F. Barker, Daniel G. Brinton, Henry Phillips, Jr., George H. Horn.

*Curators.*

Patterson Du Bois, J. Cheston Morris, Richard Meade Bache.

*Treasurer.*

J. Sergeant Price.

*Councilors (for three years).*

Aubrey H. Smith, George R. Morehouse, Samuel Wagner, William C. Cattell.

*Councilor for two years, in place of Dr. Daniel R. Goodwin, deceased.*

Dr. Charles S. Wurts.

Nominations for Librarian being in order, Mr. William P. Tatham nominated Mr. Henry Phillips, Jr.; Prof. E. D. Cope nominated Mr. Benjamin Smith Lyman.

The Secretaries presented a paper by Dr. J. Lindhal on a skull of a Megalonyx leidii, n. sp., for the Transactions. On motion, the communication was referred to a Committee of three members, to be appointed by the President, to examine and report upon.

(The President subsequently appointed Profs. Leidy, Lesley, and Heilprin as such Committee.)

Dr. J. Cheston Morris called the attention of the Society again to the subject of Vital Molecular Vibrations:

Force is not motion, as Dr. McLaughlin puts it, but that which causes motion or change in matter. While its true nature is unknown, the phenomena of the various physical forces correspond so completely with undulations or vibrations that they are recognized as such, the results of impulses brought to bear upon matter capable of atomic vibration; and the tendency of modern thought is more and more towards considering light, heat, electricity, chemical affinity and mechanic force as all of them essentially only modifications of one and the same force. But when we come to consider the phenomena of life, while we find that living bodies are all composed of material atoms similar to those of the inorganic world, another force or impulse seems to be at work suspending or reversing the ordinary action of the physical forces. It is characterized by acting, as they do, only under special conditions, viz., the presence of plasma or organizable matter, heat, oxygen, light, and a germ, itself the product of previous life. Withdraw any of these—the ordinary phenomena of inorganic matter present themselves. But whenever they are present, an organized form results which tends to follow the type of its parent forms. Fresh particles of matter are taken up and others are discharged; in other words, we have the phenomena of growth, development, secretion, excretion and of reproduction; all the physical laws and properties of matter are retained and followed, but they are subordinated to or coördinated with those of another force, which we call vital, organic or germ force, with its own laws as distinctly defined as those of chemistry or heat. It is just as unreasonable to deny the existence of the former as of the latter.

Hitherto the vibratory theory has only been applied to explaining physical phenomena. It remained for Dr. McLaughlin to extend its application to vital phenomena, by showing how completely it explains the phenomena of immunity from, and prevention of, infectious and contagious diseases by the law of *interference*. I wish to call your attention to a similar explanation of the phenomena of germ force and heredity by the law of *transference*. If two weights are suspended at proper distances from a cord fastened transversely between two pillars, and a third weight is similarly suspended between them, and motions imparted perpendicularly to each other to the two outer weights, these motions will be so transferred to the third weight as to cause it to describe a series of curves resulting from the impulses transmitted; or if a powder be dusted over a square tin plate, and the edge of the latter be touched at certain nodal points, the powder will arrange itself in certain lines and geometric figures. Is not this precisely what happens when the germ-cell and sperm-cell, the molecules of each vibrating in accordance with the impulses impressed upon it, unite in the production of the new germ, which in turn vibrates in accordance with these impulses, and proceeds accordingly to arrange and develop fresh molecules, forms and figures similar to its

antecedents? In this way we have the explanation of the germ resulting only as the harmonic product of suitable vibrations—of the hereditary transmission of qualities—and of the variations from type which occasionally occur. We have also the explanation of the cessation when life vibrations shall have been exhausted or transmuted into other forms of life itself, or so-called death. We have also the explanation of the periodicity of many, if not all, of the functions of living bodies, both in health and disease. Likewise, we have an explanation of the effects of drugs on certain organs and functions. To say "that opium produces sleep on account of its somniferous tendency" is to veil our ignorance very thinly. But, if we suppose that nerve tissue has a certain vibration, so differing in period from that of the morphia molecule which we introduce into the blood, that until the latter is eliminated or changed the nerve vibrations are modified or suspended, we can form a much more rational conception of the effect of opium. So also with the selection of appropriate food from a common plasma by different organisms, and also from the blood by the various organs and structures of the body. In fact, a new field is opened to biologists, naturalists, physiologists and physicians whose limits are at present far beyond our ken.

New nomination No. 1217 was read.

The Committees appointed at last meeting, of which Dr. Cope and Mr. Biddle were respectively Chairmen, were continued.

And the Society was adjourned by the presiding member.

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*Stated Meeting, January 16, 1891.*

Present, 73 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted and accessions to the Library were reported.

Mr. L. Vossion and Prof. G. S. Fullerton took their seats.

A circular was received from the Museo de la Plata, Argentine Republic, requesting exchanges, also sending one of its publications.

Letters of acknowledgment were received from the Geological Survey of India, Calcutta (131, 132, 133); Taschkent

Observatory, Taschkent, Russia (131, 132, 133); K. K. Geologische Reichsanstalt, Drs. Friederich Müller, Dionys Stur, Vienna (131, 132, 133); Naturwissenschaftliche Verein des Reg.-Bez., Frankfurt a. O. (131, 132, 133); Mr. Joseph Prestwich, Shoreham, Kent, England (127, 128, 129, 130); Chicago Academy of Science, Chicago (130, 131, 132, 133).

Accessions to the Library were received from the Académie R. de Belgique, Bruxelles; Naturwissenschaftliche Verein des Reg.-Bez., Frankfurt a. O.; Verein für Erdkunde, Halle a. S.; Physikalische-Medicinische Societät, München; Prof. Ferdinando Bosari, Naples; R. Accademia dei Lincei, Rome; Osservatorio Astronomico, Turin; Société de Géographie, Lille; Commission des Annales des Mines, Rédaction "Cosmos," Paris; R. Astronomical Society, Editors of the "Geological Magazine," "Nature," London; Prof. George M. Dawson, Ottawa, Canada; Museum of Comparative Zoölogy, Harvard University, Cambridge, Mass.; American Statistical Association, Boston; Editors of "American Journal of Science," Yale College, New Haven; University of State of New York, Albany; New York Historical Society, New York; Franklin Institute, Engineers' Club, College of Pharmacy, Editors of the "Homœopathic Physician," "Medical and Surgical Reporter," "Medical News," American Bar Association, Mercantile Library, Messrs. J. E. Ives, Henry Phillips, Jr., Philadelphia; U. S. Naval Institute, Annapolis; Johns Hopkins University, Editors of "American Journal of Philology," "American Chemical Journal," Baltimore; Department of State, U. S. Naval Observatory, Smithsonian Institution, Anthropological Society, Hydrographic Office of U. S. Navy, Prof. Albert S. Gatschet, Washington, D. C.; Public Library of Cincinnati; Musée de la Plata.

The stated business of the meeting was then taken up, and, on motion, the Society resolved to proceed to the election of Librarian for the ensuing year. It was resolved to conduct the same by ballot, and that the polls should remain open thirty minutes, during which the Society took a recess to enable the members present to deposit their votes.

J. Sergeant Price, Esq., and Dr. Persifor Frazer were appointed by the Chair as tellers to conduct the said election; who, after the polls had been closed, reported to the President that Mr. Henry Phillips, Jr., had received 39 votes, and Mr. Benjamin Smith Lyman, 31 votes; whereupon the President declared Mr. Henry Phillips, Jr., to have been duly elected Librarian of the Society for the ensuing year.

[Secretary Phillips being present and not voting.]

On motion, the President was authorized to appoint at his leisure the Standing Committees of the Society, which he subsequently selected, as follows:

*Finance.*

William B. Rogers, Philip C. Garrett, Charles S. Wurts.

*Hall.*

J. Sergeant Price, William A. Ingham, Charles A. Oliver.

*Publication.*

Daniel G. Brinton, George H. Horn, Samuel Wagner,
Patterson DuBois, Horace Jayne.

*Library.*

Edwin J. Houston, William V. McKean, William John Potts,
Jesse Y. Burk, William H. Greene.

The Committee on the Paper of Dr. J. Lindahl reported the same to be worthy of publication, which was so ordered, and the Committee was discharged.

Prof. Cope's Committee and Mr. Arthur Biddle's Committee reported progress and were continued.

Pending nomination, No. 1217, and new nominations, Nos. 1218 and 1219, were read.

And the Society was adjourned by the President.

*Stated Meeting, February 6, 1891.*

Present, 17 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted and accessions to the Library were announced.

The President announced the death of Hon. George Bancroft (January 17, 1891), æt. 91, and, on motion, was authorized to appoint a suitable person to prepare the usual obituary notice. Prof. J. Bach McMaster was subsequently appointed.

Pending nominations 1217, 1218 and 1219 were read.

Mr. Arthur Biddle presented a report from the Committee on the Etting Bequest, recommending that the Society decline to take any part in the litigation arising out of the caveat filed to the last two codicils of the will of F. M. Etting, deceased, now pending, and that the Society decline to act as Trustee under said will.

On motion of Mr. Horner, the report was accepted.

On motion of Dr. Morris, the Society declined to litigate under the caveat to the last two codicils now pending.

On motion of Mr. Horner, the Society declined to accept the trust.

On motion of Mr. Biddle, the Secretaries were requested to notify the executors of the action of the Society.

And the Society was adjourned by the President.

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*Stated Meeting, February 20, 1891.*

Present, 12 members.

Mr. WILLIAM A. INGHAM in the Chair.

The death of Prof. Alexander Winchell, Ann Arbor, Mich., February 18, 1891, æt. 72, was reported.

Correspondence was submitted and accessions to the Library were reported.

The Free Public Library, Jersey City, was placed on exchange list to receive Proceedings.

The Library Committee reported suggestions to facilitate the replacing of the books on the shelves in the Society's Library; that the Library room should be finished; that bookcases to contain works of reference should be placed in the meeting room, and that the Society should appropriate $500 for the purchase of new books.

After this latter recommendation had been presented, a letter was read from the Treasurer requesting that no appropriation should be made for that purpose for the present, giving his reasons for the same.

The Committee's recommendation was postponed for the present.

The minutes of the Board of Officers and Council were submitted.

Pending nominations Nos. 1217, 1218 and 1219 were read, spoken to, and balloted for, and No. 2187, Commander F. M. Green, U. S. School Ship *Saratoga*, was declared elected a member of the Society.

And the Society was adjourned by the presiding member.

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*Stated Meeting, March 6, 1891.*

Present, 19 members.

President, Mr. FRALEY, in the Chair.

Correspondence was presented and donations to the Library reported:

A letter from Theodore Turrettini (Geneva, February 8, 1891) accepting membership.

A circular in relation to the formation of State library associations.

A circular in relation to the Fifth International Geographical Congress to be held in Washington, August 26, 1891.

A circular from the Society of Borda, Dax, announcing the death of M. Henry du Boucher, a former President.

A circular from l'Académie des Sciences, etc., de Belgique, announcing the death of Lieut.-General J. B. I. Liagre, its Permanent Secretary.

A letter from R. Brabbée (Vienna VIII, Kochgasse 27) enclosing a specimen of his new method of reckoning.

A letter from Dr. Antonio Del Bon (Padua) in relation to Prof. P. E. Chase's paper on "English and Sanskrit Root-analogues."

Letters from August Tischner (Leipzig) on "The Celestial Phenomena," "The Movements of the Sun in Space," "The Movements of the Planets," "The Solar System" and "The Elements of the Elliptic Orbits."

A paper by Dr. D. G. Brinton entitled "Some Vocabularies from the Musquito Coast" was presented.

Dr. J. Cheston Morris presented a pamphlet entitled "Tepeu" (by Dr. Thomas E. Pickett), on the hypothetical migrations of the *Morbus Americanus*, upon which he made some remarks, referring to the account given by Josephus of the evils caused the Jewish youth by the entrance of the Midianitish women into the Hebrew camp.

Dr. J. Cheston Morris made some remarks on "Hebrew Phonetics," and was followed by Prof. J. P. Lesley upon the same subject.

Prof. Lesley made some remarks on a report by Mr. John Fulton (Johnstown, Pa.) on the diminution of the supply of natural gas and its ratio.

Dr. Morris called attention to the case of the miners recently entombed at Jeanesville, Pa., for nineteen days almost without food. "They were found in a breast near where they had been working. The water from an abandoned mine at a much higher level, estimated at 145 feet, had entered the mine and

imprisoned them. This is the longest period in the history of mining in Pennsylvania of preservation of life under such circumstances. And in this connection it may be also well consider that in no case on record has an attempt at cannibalism been made by the sufferers. This fact should be placed to the credit of a class of men too often unjustly despised and maligned. When these men were borne alive from the mine, the whole crowd of bystanders accompanied them to the temporary hospital singing the doxology.

"The level of the water in abandoned mine dropped slowly, day by day, in consequence of pumping incessantly, at rates varying from two to fourteen feet."

New nominations Nos. 1220, 1221 and 1222 were read.

The Committee on Improved Accommodations reported progress.

Prof. Cope, from the Committee appointed December 19, 1890, to consider the improvement of the Proceedings of the Society, presented a report.

Considerable discussion took place upon the same, and the following resolution was adopted, *nem. con.*:

*Resolved*, That the Report and Resolutions accompanying be recommitted to the same Committee, and the Committee be continued in order to obtain fuller data as to the matters therein referred to; and the Committee be instructed to present its Report at the first meeting of the Society in May, 1891 (May 1).

On motion, the Society

*Resolved*, That the Treasurer, J. Sergeant Price, Esq., be authorized and directed to give notice to the City of Philadelphia to quit the rooms in the building of the Society now occupied by it for the use of the courts and its officers, at the end of the present tenancy, viz., on the 1st of July, 1891.

And the Society was adjourned by the President.

*Stated Meeting, March 20, 1891.*

Present, 3 members.

Dr. J. CHESTON MORRIS in the Chair.

Correspondence was submitted as follows:

Letters of envoy were received from the Ministère des Travaux Publics, Paris; Meteorological Office, London.

Letters of acknowledgment were received from Royal Society of Victoria, Melbourne, Australia (131, 132, 133); Mr. Samuel Davenport, Adelaide, Australia (130); Royal Society of N. S. Wales, Sydney, Australia (131, 132, 133); Tokyo Anthropological Society (131, 132, 133); Société R. des Sciences, Upsal, Sweden (130, 131, 132, 133, and Trans. xvi, 3); Friesch Genootschap, Leuwarden (133); R. Accademia degli Agiati, Rovereto, Austria (129, 130, 132, 133); Prof. Hermann Rollett, Vienna (129, 130, 132, 133); Prof. Hauer, Vienna, Austria (132, 133); Naturwissenschaftliche Wochenschrift, Berlin (131, 132, 133); K. Bibliothek, Berlin (131, 132, 133); Naturforschende Gesellschaft, Emden (131, 132, 133); Prof. E. Hœckel, Jena (131, 132, 133); Dr. Julius Platzmann, Leipzig (131); Verein für Vaterländische Naturkunde, Stuttgart (131, 132, 133); Am. Geog. Society, New York (131); Mr. L. Vossion, Philadelphia (131, 132, 133, 134); Denison Scientific Association, Granville, O. (131, 132, 133); Michigan State Library, Lansing (131, 132, 133, 134); Museo National de Buenos Aires (125, 126, 127, 128, 129, 131, 132, 133).

Letters of acknowledgment (134) were received from Mr. J. M. Le Moine, Quebec; Toronto University Library, Canadian Institute, Sir Daniel Wilson, Toronto; Geological Survey, Ottawa; Maine Historical Society, Society of Natural History, Portland, Me.; New Hampshire Historical Society, Concord; Dr. C. N. Hitchcock, Hanover, N. H.; Amherst College, Boston Society of Natural History, Mass. Historical Society, Athenæum, Messrs. T. M. Drown, Robert C. Winthrop, S. P.

Sharples, Boston; Museum of Comparative Zoölogy, Profs. A. Agassiz, Robert N. Toppan, Cambridge; The Essex Institute, Salem; American Antiquarian Society, Worcester; Free Public Library, New Bedford; Mr. James B. Francis, Lowell; Prof. Pliny Earle, Northampton, Mass.; New Haven Colony Historical Society; Connecticut Historical Society, Hartford; Mr. George F. Dunning, Farmington, Conn.; New York State Library, Albany; Hamilton College, Clinton; Profs. T. F. Crane, J. M. Hart, B. G. Wilder, Ithaca; Vassar Brothers' Institute, Poughkeepsie; Rochester Academy of Science; Library of U. S. Military Academy, West Point; The Oneida Historical Society, Utica, N. Y.; New York Hospital, University of the City of New York, Dr. John J. Stevenson, Columbia College, Gen. Henry L. Abbot, Meteorological Observatory, American Museum of Natural History, New York; New Jersey Historical Society, Newark; Free Public Library, Jersey City; Prof. C. A. Young, Princeton; Mr. Isaac C. Martindale, Camden, N. J.; Dr. Robert H. Alison, Ardmore; Mr. Burnet Landreth, Bristol; Dr. Martin H. Boyè, Coopersburg; Mr. Eckley B. Coxe, Drifton; Drs. Traill Green, J. W. Moore, Thomas C. Porter, Easton; Mr. Andrew S. McCreath, Harrisburg; Haverford College; Drs. Allen C. Thomas, Isaac Sharpless, Lyman B. Hall, Haverford College; Mr. J. N. Fulton, Johnstown; Linnean Society, Lancaster; Mr. P. F. Rothermel, Linfield; Messrs. Heber S. Thompson, P. W. Sheafer, Pottsville; Mr. M. Fisher Longstreth, Sharon Hill; Lackawanna Institute of History and Science, Scranton; Philosophical Society, Messrs. Washington Townsend, Philip P. Sharples, West Chester, Pa.; Library of the Pennsylvania Hospital, Engineers' Club of Philadelphia, Philadelphia Library, Wagner Free Institute of Science, Zoölogical Garden, Franklin Institute, Academy Natural Science, Messrs. John Ashhurst, Jr., Andrew A. Blair, Charles Bullock, Edwin J. Houston, S. Castner, Jr., Thomas M. Cleemann, C. S. Dolley, Samuel Dixon, Patterson Du Bois, Frederick Fraley, Persifor Frazer, George Friebis, George S. Fullerton, Horace Howard Furness, H. D. Gregory, F. A. Genth,

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Fred. A. Genth, Jr., Edward Hopper, W. A. Ingham, William W. Jefferis, W. W. Keen, J. P. Lesley, John Marshall, Geo. R. Morehouse, James T. Mitchell, E. Y. McCauley, Charles A. Oliver, J. Sergeant Price, Robert Patterson, William Pepper, Henry Phillips, Jr., Franklin Platt, C. N. Peirce, W. S. W. Ruschenberger, Henry Reed, Theo. D. Rand, James W. Robins, L. A. Scott, Benjamin Sharp, Albert H. Smyth, Aubrey H. Smith, H. Clay Trumbull, Samuel Wagner, William H. Wahl, Henry Willis, Mrs. Helen Abbott Michael, Philadelphia; Rev. F. A. Mühlenberg, Reading, Pa.; U. S. Naval Institute, Annapolis; Peabody Institute, Maryland Institute, Maryland Historical Society, Baltimore, Md.; Bureau of Ethnology, U. S. Geological Survey, Smithsonian Institution, U. S. Signal Office, U. S. Naval Observatory, Surgeon-General's Office, Anthropological Society, Patent Office, Rt. Rev. John J. Keane, Messrs. Charles A. Schott, H. Haupt, Albert S. Gatschet, Garrick Mallery, W. Strong, Washington, D.C.; Prof. J. C. White, West Virginia University, Morgantown, W. Va.; University of Virginia, University of Virginia P. O.; Mr. Jed. Hotchkiss, Staunton, Va.; Elliott Society of Science and Art, Charleston, S. C.; Georgia Historical Society, Mr. William Harden, Savannah, Ga.; University of Alabama; Denison Scientific Association, Granville; Cincinnati Society Natural History, Cincinnati Observatory; Rev. Henry S. Osborn, Oxford; Dr. E. W. Claypole, Akron, O.; Dr. Robert Peter, Lexington, Ky.; Athenæum, Columbia, Tenn.; University of Tennessee, Knoxville, Tenn.; University of Illinois, Champaign, Ill.; The Newberry Library, Chicago, Ill.; Dr. John L. Campbell, Crawfordsville, Ind.; State Historical Society of Wisconsin, Madison; Prof. J. C. Branner, Little Rock, Ark.; Col. William Ludlow, Gen. W. F. Raynolds, Detroit; Prof. Alexander Winchell, Ann Arbor, Mich.; Colorado Scientific Society, Denver; Kansas State Historical Society, The Kansas Academy of Science, Topeka; Observatorio Astronómico National Mexicano, Tacubaya, Mexico.

Accessions to the Library were reported.

Pending nominations 1220, 1221, 1222, and new nominations 1223, 1224, 1225 and 1226 were read.

And the Society was adjourned by the presiding member.

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*Stated Meeting, April 3, 1891.*

Present, 13 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted.

Accessions to the Library were reported.

Prof. Lesley read an obituary notice of the late Peter W. Sheafer (b. March 31, 1819; died at Pottsville, March 26, 1891).

The death of Dr. Thomas B. Reed was announced (Philadelphia, April 1, 1891, æt. 59).

Prof. Lesley read a paper "On An Important Boring Through 2000 Feet of Trias in Eastern Pennsylvania," which was followed by some remarks on the subject by Mr. B. S. Lyman.

Pending nominations, Nos. 1220, 1221, 1222, 1223, 1224, 1225 and 1226 were read.

The report of the Trustees of the Building Fund was presented.

And the Society was adjourned by the President.

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*Stated Meeting, April 17, 1891.*

Present, 13 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter was received from the American Consul General, Melbourne, Australia, asking the Society to participate in a

scientific expedition to the Solomon Islands and other places, with a view of collecting ethnological and anthropological specimens.

A circular was received from the Royal Society of New South Wales, offering its medal and money prize, for the best communication containing the results of original research or observation upon scientific subjects.

An invitation was received from the Hungarian Committee to attend the Second International Ornithological Congress, which will be held in Budapest at Whitsuntide, 1891.

Letters were received from the Société Hongroise de Géographie, and from the "Journal of Comparative Neurology," Cincinnati, Ohio, asking for exchanges, which were so ordered.

Letters of envoy were received from the Royal Society of New South Wales, Sydney; Musée Teyler, Haarlem; Nederlandsche Letterkunde, Leiden; Ministère de l'Instruction Publique, Paris; Bath and West and Southern Counties Societies, Bath, England; Royal Statistical Society, London; Mr. Frank Vincent, New York; Department of the Interior, Smithsonian Institution, Washington, D. C.

Letters of acknowledgment were received from the Tokyo Library (131, 132, 133); Université Royale, Lund, Sweden (130, 131, 132, 133); Physikalisch-Medizinische Societät, Erlangen (131, 132, 133); K. Sächs. Alterthumsverein, Dresden (131, 132, 133); Oberhess. Gesellschaft für Natur- und Heilkunde, Giessen (131, 132, 133); Prof. Otto Bottlingk, Leipzig (131, 132, 133); K. K. Sternwarte in Prag (130); Museum d'Histoire Naturelle, Strasburg (131, 132, 133); Naturforschende Gesellschaft, Schweiz. Naturforsch. Gesellschaft, Bern (131, 132, 133); Biblioteca Nazionale Centrale, Firenze (131, 132, 133); R. Comitaté Geologico D'Italia, Rome (131, 132, 133).

Mr. R. Meade Bache read a paper on "Possible Sterilization of City Water," which was followed by a discussion.

Pending nominations 1220, 1221, 1222, 1223, 1224, 1225 and 1226, and new nominations Nos. 1227, 1228 and 1229 were read.

And the Society was adjourned by the President.

*Stated Meeting, May 1, 1891.*

Present, 13 members.

President, Mr. FRALEY, in the Chair.

Letters of envoy were received from the K. Akademie der Wissenschaften, Vienna, Austria; Société des Sciences Naturelles et Archéologiques de la Creuse, Guéret, France.

Letters of acknowledgment were received from the Naturhistorische Gesellschaft, Hanover, Prussia (131, 132, 133); R. Accademia dei Lincei, Prof. G. Sergi, Rome (131, 132, 133); Marquis Antoine de Gregorio, Palermo, Sicily (131, 132, 133); Société Nationale des Sciences Naturelles et Mathematiques, Cherbourg, France (131, 132, 133); Société des Sciences Naturelles et Archéologiques de la Creuse, Guéret, France (131, 132, 133); Prof. Léon de Rosny, Paris (131); Société Académique, Troyes (131, 132, 133); Société Polymathique de Morbihan, Vannes (131, 132, 133); Sir J. W. Dawson, Montreal (134); State Library of Massachusetts, Boston (134); Prof. Elihu Thomson, Swampscott, Mass. (134).

At request of the Kg. Norske Videnskabers Selskab, Throndhjem, Norway, it was placed on list to receive Proceedings from 131.

The following societies were placed on the exchange list to receive Proceedings from No. 131:

K. Sächs. Meteorologische Institut, Leipzig; K. Sächs. Sternwarte, Leipzig; Académie des Sciences, etc., Angers, France; Schlesische Gesellschaft für Vaterländische Kultur, Breslau, Germany; Società Italiana delle Scienze (5 Piazza S. Pietro in Vincoli), Rome, Italy; Naturwiss. Verein, Regensburg, Germany; Bureau für Wetter Prognose, Leipzig, Saxony; Naturhist. Landes-Museum, Klagenfürt, Austria; Société Géologique de Normandie, Havre, France.

An engraved portrait of the late Prof. Von Rath was presented by his widow.

The following deaths of members were announced:

Rev. S. S. Lewis (Cambridge, England), March 31, 1891.

Dr. John LeConte (Berkeley, Cal.), April 29, 1891, æt. 73 (b. Dec. 4, 1818).

Dr. Joseph Leidy (Philadelphia), April 30, 1891 (b. Sept. 9, 1823).

On motion, the President was authorized to appoint suitable persons to prepare the usual obituary notices of Dr. Leidy and Dr. LeConte.

Prof. Lesley read a paper on "Artesian Wells in Philadelphia, Norristown, Montgomery and Delaware Counties," with notes by Prof. Oscar C. S. Carter.

Prof. Lesley presented a paper by Prof. Oscar C. S. Carter on "The Feldspar Bed in the Laurentian Gneiss near Lafayette Station."

Mr. Holman made an oral communication in relation to a new microscope, lately invented by him, by which objects distant from its front lens over two and a half feet could be readily examined in their habitat. For example, at that distance a salamander of a few inches in size would appear some thirty inches in length, and its whole circulation of blood would be plainly visible. The instrument uses a photographic lens as an object glass, and is really a short-focus telescope.

Pending nominations Nos. 1220 to 1229 (inclusive) were read.

Mr. J. Sergeant Price, the Treasurer, having reported to the Society that he had received through its attorney, Mr. John H. Harjes, of Paris, the sum of three thousand eight hundred and fifty-five dollars and forty-two cents, the full amount of the legacy of twenty thousand francs (at the exchange of 5.18¾ francs per docia) given to it by the will of the late Mr. Auguste Carlier, of Paris, a member of our Society, submitted the following resolutions, which were unanimously adopted:

*Resolved*, That the thanks of the Society be returned to Mr. Louis Vossion, the French Consul at Philadelphia, for his aid in preparing the necessary papers and certificates therein for presenting our claim for said legacy to Mr. P. Massion, of Paris, the Executor of Mr. Auguste Carlier; he as a member of our Society declining to make any charge therefor for fees and expenses.

*Resolved*, That the thanks of the Society be returned to Mr. John H. Harjes, of the firm of Messrs. Drexel & Co., for his valuable services as our representative in Paris, in obtaining from Mr. P. Massion, the Executor of Mr. Auguste Carlier, the legacy of twenty thousand francs given to us by his will and remitting the same to us without any charge for the time and care given to our interests, which acts of kindness are highly appreciated by the Society.

The Committee on Extended Accommodations reported progress.

The deferred business being in order, the report of the Committee submitted March 6, 1891, was taken up.

Prof. Cope moved that the consideration of the same be postponed until the next regular meeting of the Society, and that notice thereof should be placed upon the meeting postal-cards.

Mr. Price moved, as a substitute and amendment, that the consideration of the report should be postponed until the first regular meeting in November, 1891.

The amendment, being put to a vote, was declared carried.

The resolution as amended was then unanimously adopted.

And the Society was adjourned by the President.

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*Stated Meeting, May 15, 1891.*

Present, 19 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows: A circular was received from the Observatorio de San Fernando announcing the death of the Director of the Observatory, Sr. D. Cecilio Pujazon.

Letters of envoy were received from the K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Royal Statistical Society, London.

Letters of acknowledgment were received from the Linnæan Society of New South Wales, Sydney (130); Rhode Island Historical Society, Providence (134); Prof. O. N. Rood, New York Academy of Sciences (134); Dr. Morris Longstreth, Messrs. John R. Baker, J. S. Harris, George de B. Keim, George Stuart, College of Pharmacy, Philadelphia (134); State Library of Pennsylvania, Harrisburg (134); Mr. John F. Carll, Pleasantville (134); Prof. J. T. Rothrock, West Chester (134); Wyoming Historical and Geological Society, Wilkesbarrè (134); Signal Office, Washington (131, 132, 133, and Transactions xvi, 1, 2, 3); Leander McCormick Observatory, University of Virginia (134); Denison Scientific Association, Granville, O. (134); Davenport Academy of Sciences, Davenport, Iowa (134); Observatorio Nacional de Tacubaya, Sociedad Cientifica "Antonio Alzate," Mexico (134); Museo Michoacano, Morelia; Bishop Crescencio Carrillo, Merida, Yucatan (134).

Dr. Ruschenberger read an obituary notice of the late Dr. Gouverneur Emerson.

The death of Julius E. Hilgard (Washington, D. C.), May 2, 1891, was announced.

The President reported that he had appointed Dr. Ruschenberger to prepare the obituary notice of the late Dr. Leidy, and Prof. Barker that of the late Dr. LeConte (Berkeley, Cal.).

Mr. R. Meade Bache read a paper entitled "A Fragment of Objectionable University-Extension Teaching."

The minutes of the Board of Officers and Council were submitted.

Pending nominations Nos. 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228 and 1229 were read, spoken to and balloted for.

At the call of Committees, Prof. E. J. Houston, Chairman, reported a minute of resolutions adopted at the last meeting of the Committee on Library, but the hour of 10 P.M. having arrived, after which, by the laws of the Society (Chapter ix, § 5), it is not permitted to take up new business, the considera-

tion of the Report and the matters therein contained, was postponed, on motion, to an adjourned meeting of the Society to be held at its Hall on May 29, 1891, at 8 P.M.

Secretaries Barker and Brinton, the tellers appointed to conduct the balloting for members, reported the following to have been duly elected members:

2188. Dr. René Gregory, Leipzig.

2189. Prof. Henry W. Spangler, University of Pennsylvania, Philadelphia.

2190. Prof. A. de Quatrefages, Membre de l'Institut, Paris, France.

2191. Sir Robert S. Ball, Astronomer Royal for Ireland, Dublin.

2192. Prof. Charles E. Munroe, Newport, R. I.

2193. Right Rev. William Stubbs, LL.D., D.D., Bishop of Oxford, England.

2194. Dr. E. T. Hamy, Conservator du Musée du Louvre, Paris, France.

2195. Prof. Jules Oppert, Membre de l'Institut, Paris, France.

2196. Prof. Gaston Maspero, Paris, France.

And the Society was adjourned by the President.

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*An Adjourned Meeting was held May 29, 1891.*

Present, 11 members.

President, Mr. FRALEY, in the Chair.

The President stated the object of the meeting.

Prof. Edwin J. Houston, Chairman, read the following ex-

tract from the minutes of the last meeting of the Committee on Library:

The Library Committee respectfully reports to the Society that it is unable to understand the plans of the Committee on Extended Accommodations as regards the general character of the new bookcases to be furnished, their location, number and size.

The Library Committee cannot intelligently carry on the work delegated to it by the Society, unless its duties and those of the Committee on Extended Accommodations be clearly defined by the Society.

A general discussion took place, and the Chairman of the Committee on Extended Accommodations explained the work and the plans of the Committee.

Prof. Houston stated the points at issue to be three, viz.:

1. Does the Society desire all its books to be placed in the new Library room? or,
2. Does it wish any in the North room? or,
3. Does it wish any in the Meeting room.

On motion of Dr. Morris it was, *nem. con.*:

*Resolved*, That the stock of publications issued by the Society shall be placed in a portion of the North room.

On motion of Dr. Hayes it was, *nem. con.*:

*Resolved*, That the Committee on Extended Accommodations be directed to locate and construct cases for books, and cabinets, in accordance with plans to be approved of by the *Library Committee*.

On motion of Prof. Smyth it was, *nem. con.*:

*Resolved*, That Daniel G. Brinton and Henry Phillips, Jr., and each of them, be appointed delegates to represent this Society at the meeting at Moscow, this year, of the Congres International d'Anthropologie et Archéologie Prehistoriques, provided that the said appointment shall entail no expense whatever upon the Society.

And the Society was adjourned by the President.